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Joachim Singelmann
Dudley L. Poston, Jr *Editors*

Developments in Demography in the 21st Century

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Developments in Demography in the 21st Century

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We dedicate this book to two of the best teachers, mentors, collaborators, colleagues and friends we have ever had, ***Harley L. Browning*** *and* ***Jack P. Gibbs****. Thanks to both of you for everything you have ever done for us over the past 50 years.*

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Part I
Introduction

Chapter 1
Developments in Demography

Joachim Singelmann and Dudley L. Poston, Jr

1.1 Introduction

A knowledge of the demographic structure of a society is of crucial importance for decision making. Demography is the social science that studies (1) the size, composition, and distribution of human populations; (2) the changes in population size and composition and distribution over time; (3) the components of these changes, i.e., fertility, mortality, and migration; (4) the factors that affect these components; and (5) the consequences of changes in population size, composition, and distribution, or in the components themselves. Demography is important because it makes many societal outcomes more likely than others. For example, the age structure of the U.S. population at the time of the introduction of Social Security made it more likely that this program was funded intergenerationally instead of building up individual annuities, because at that time, there were far fewer people in retirement ages than in working ages. The ultimate decision, however, was a political one.

The sex ratio of a population is another demographic factor influencing social outcomes. When there is a large imbalance in the number of males and females at the typical ages at marriages, say, many more males than females, the possible responses could be the outmigration of some of the males, an increase in out-of-wedlock births (if the number of females happened to exceed the number of males, as has been in the case in some Caribbean islands), or an inmigration of females, as is now happening in China and South Korea and some other countries where there

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is a large surplus of young males. Again, which outcome actually takes place is not fully "decided" by demography; the specific outcome is the result of social and political decisions. That is, demography is not destiny, but the demographic structure of a society makes certain policy decisions more likely than others.

We often hear the expression, "Demography is destiny." Indeed, the founding father of sociology, August Comte, is believed to be the first person to have made such a statement. Today, commentators and news analysts sometimes use the phrase as an explanation of how things are, and how they got that way, and how they will be. Some demographers, however, tend to shy away from the expression. While there is some validity to the phrase, "demography is destiny," there are many other variables that intervene in determining where an individual or a society stands at any given point in time. Nevertheless, there are instances in the study of demography, particularly with respect to population behavior occurring in relatively short periods of time, when it can indeed be argued that demography is destiny.

For instance, consider the large number of births, i.e., the baby boom, that occurred in the U.S. from the mid-1940s until the early 1960s. We have known for many years that by the year 2020, there will have occurred a very large population increase in the numbers of elderly people in the United States. Why? Because we know how many people were born during the baby boom period, and we can be fairly accurate as to how many have already entered and will be entering the elderly years of life. A similar statement can be made with regard to the many, many millions of baby boys already born in China and South Korea, and elsewhere, i.e., in India and Taiwan, who, when it is time for them to marry, will not be able to find Chinese or Taiwanese or South Korean or Indian brides. These boys have already been born, and we know that they far outnumber the women who will be there for them to marry.

A major strength of demography is that a large body of research has an applied focus. Perhaps more than so than in other social sciences, a key concern of demography is the focus on the quality of data. In large part, this is due to the fact that census data are the source of much demographic analysis. Another major data source is vital statistics; indeed, the improvement of birth and death registries has been a long-term objective of demography. Aging and health are other main topics of demography. And a large part of our knowledge about urbanization, marriage patterns, or poverty, to name just a few social issues, is informed by social demographic analysis. For each of the aforementioned topics, demographic analysis has been a key input for policy planning. For much of demography, there is a short step from analysis to policy application, assuming that political actors value evidence-based policy planning.

The origin of this volume was the Applied Demography Conference held in San Antonio, Texas in 2014. From the many outstanding presentations at the meeting, the two editors, Joachim Singelmann and Dudley Poston, have selected those that combined two characteristics: first, they are theoretically and/or methodologically at the forefront of development in demography; and second, there is some focus on public policy issues. However, not all the chapters in this volume were presented at the conference. The editors decided to include a few other chapters that also represent the above two characteristics.

The four sections of the volume thus are methods and statistics; data issues; health, aging, and mortality; and social demography. All reflect the topics that we listed above as major foci of applied demography. The chapters in these sections add knowledge that is helpful for public policies. In the paragraphs below, we briefly summarize the main findings of the selected chapters.

1.2 Developments in Demography: Chapter Summaries

In Chap. 2, "What's Changing the World? A Demographer's Perspective," Wendy Baldwin entertains the very broad issue of population changes in the decades ahead in the world and in its major regions and countries. She correctly notes that most of the countries of the world have improved their levels of educational attainment and have increased their control over infectious diseases. However, there has been a marked shift in past decades in many countries from infectious to non-communicable diseases, and she notes that this shift will accelerate in the coming years. This is a matter of special interest in low and middle income countries because non-communicable diseases occur at earlier ages there than they do in wealthier countries. The earlier onset means that these diseases will also tend to lower their economic productivity. Baldwin shows clearly how and why the growing burden of non-communicable diseases in the future in the developing world will challenge individuals, families, communities and nations.

In Chap. 3, "A Demographic Evaluation of the Stability of American Community Survey (ACS) Estimates for ACS Test Sites: 2000 to 2011," Gregory Robinson and Eric Jensen report the results of a demographic evaluation of the stability of American Community Survey (ACS) estimates from 2000 to 2014. They consider the estimates to be stable when differences between demographic groups are maintained over time. They focus in particular on differentials in the poverty and ownership rates for race and Hispanic origin groups. They examine the consistency of the ACS estimates since 2000 and compare them to benchmarks from the 1990 and 2000 decennial censuses. They show that the differential poverty and ownership rates are consistently estimated by the ACS in each period and agree with the differentials reported in the decennial census data.

Eugenia Conde and Dudley Poston are concerned in Chap. 4, "Approaches for Addressing Missing Data in Statistical Analyses of Female and Male Adolescent Fertility" with how to address the issue of missing data in statistical analyses of adolescent fertility. Several of the variables they use in their analyses have extensive amounts of missing data. They undertake separate analyses for females and for males of the likelihood of the respondent reporting having had a teen birth. They handle the problem of missing data by using several different missing data statistical approaches. They show that depending on the missing data method used, many of the independent variables in the sex-specific models vary in whether they are, or are not, statistically significant in predicting the log odds of having had a teen birth, and in the ranking of the magnitude of their relative effects on the outcome.

In Chap. 5, “Considering Local Measures of Poverty Using Shift-Share Techniques: A Comparative Analysis,” Gregory Hamilton and Melody Muldrow note that poverty studies typically use family income or individual income as their measures of poverty. In contrast, they propose an alternative method to measure poverty in a local economy that is based on shift-share analysis which permits them to identify some of the possible local causes of poverty. They apply a shift-share method to all the counties in Arkansas to find out whether this method yields the desired identification of local effects on poverty. Their careful analysis shows that shift-share does not improve the conventional way of examining poverty at the local level. This non-finding is important because shift-share analysis has often been viewed as a useful tool for localizing effects on the outcome variable. Hamilton and Muldrow demonstrate that such is not the case for examining poverty at the local level.

In Chap. 6 on “Potential Explanations for the High Net Undercount of Young Children in the U.S. Census,” William O’Hare focuses specifically on the undercount of young children in the U.S. 2010 decennial census and the extent to which several factors may be at work influencing the undercount. Two issues to which he gives considerable attention are, one, the belief expressed by some that the federal government does not wish to include young children in the census counts, and, two, the fact that some respondents completing the census form do not want the government to know about the existence of their young children. Although he does not find any systematic statistical evidence about the extent to which these two beliefs would affect the net undercount of young children, he believes that these issues certainly deserve additional research, both qualitative and quantitative.

In Chap. 7, “Babies no Longer: Projecting the 100+ Population,” Sandra Colby and Howard Hogan observe that although most demographers know that the aging of the baby boomer cohort in the U.S. will certainly contribute to the future growth of the centenarian population, they do not really know exactly how much growth to anticipate. In their chapter, they first conduct a literature review on the issue of maximum life expectancy to get an idea of the range of the future size in the U.S. of this 100+ population. They next evaluate Census Bureau projections of life expectancy with those of other agencies producing similar products for the United States and for other developed nations. They also explore historic changes in the centenarian population to provide context for the projected changes. They then develop and report data for various sets of projections of the centenarian population. Their projected numbers all make clear that there will be a substantial increase in the centenarian population.

Chapter 8, “Cohort Approaches Using Educational Data of the Czech Republic: Massification of Tertiary Education and Its Impact on Education Attainment,” Vladimír Hulík and Klára Hulíková Tesárková analyze the expansion of higher education in the Czech Republic. They base their analysis on Martin Trow’s theory of massification of higher education according to which it is impossible to maintain the elite system of higher education in the face of the expansion of that educational segment, with the same holding true once mass education becomes universal. Their analyses show that the Czech tertiary education system changed from elite to mass in the early 1990s, and from mass to universal in the middle of the 2000s. On the basis of these findings, they construct a robust multi-state model of educational attainment to project educational attainment in the Czech Republic through 2050. Their projections are important because of the central role of education in explaining changes in other demographic factors such as fertility, mortality, migration, and health status.

Ernesto Amaral and Joe Potter analyze in Chap. 9, "Factors Associated with Female Sterilization in Brazil." They are especially interested in adding to their sterilization survival models a variable that captures the amount of time of exposure to the risk of sterilization. They show that sterilization is greater among older women, among those with two children at delivery, and among those residing in areas of elevated fertility rates, namely the Brazilian regions in the North and Northeast. Their analyses also indicate that women who had a Cesarean section, gave birth at private hospitals, or with the support of health insurance experienced the greatest chances of becoming sterilized following a birth. Given this finding, Amaral and Potter argue that the Brazilian government needs to implement family planning programs with equal access to sexual and reproductive health services for all women.

Chapter 10, "Aging and Family Support in the State of Mexico" by Viridiana Sosa Marquez, examines the current situation of people 60 years and older who are living in the State of Mexico. Sosa Marquez first provides information about the living arrangements of the elderly in terms of marital status and household size, to show the potential family help that people could expect to receive as they grow older. She points out that most elderly Mexicans have either a spouse or children living with them, and they often have other children in separate households, reflecting the relatively high fertility of that generation. She concludes, however that to fully answer the question of the extent to which the elderly in the State of Mexico can count on support from family members, one needs to complement the demographic analysis with additional qualitative work.

In Chap. 11, "Intimate Homicide Mortality in Alaska from a Demographic Perspective," Donna Shai analyzes intimate homicide, that is, a homicide committed by a current or former legal or common-law spouse, boyfriend or girlfriend. She undertakes a qualitative analysis of twelve intimate homicides, selected from the 23 such homicides reported in the state of Alaska between 2007 and 2012. She shows that although most of the homicides were perpetrated by men, almost a quarter were perpetrated by women. The motives behind the men's attacks in some cases are a sense of maintaining a hold on the women, and using great force, despite the women's objections. Alternately, the women's motives range from self-defense to anger over infidelity. In both cases, Shai concludes that couples could have profited from counseling, especially in order to end relationships without violence and tragedy. Agencies, including the military, she argues, should take special steps to prevent multiple family homicide by carefully monitoring the reentry of service men and women to civilian family life.

Chapter 12 by Silvia Mejía Arango, Joachim Singelmann, and Rogelio Sáenz, "Cognitive Decline among the Elderly: A Comparative Analysis of Mexicans in Mexico and in the United States," is a longitudinal analysis of the factors affecting cognition among the elderly in Mexico and elder Mexican Americans in the United

States. The authors ask the following two questions: (1) what are the similarities and differences between Mexicans in Mexico and Mexicans in the United States in the factors that influence cognitive impairment; and (2) are the sex differentials in the factors predicting cognitive impairment in Mexico similar or different for Mexican Americans? Their findings show that after a 10-year period, cognitive decline is higher among Mexican Americans than among Mexicans in Mexico. They also show that while Mexican women in Mexico have a higher incidence of cognitive decline than their male counterparts, the reverse is true for Mexican Americans. Their research supports the hypothesis of a negative association between acculturation and health status among Mexican migrants. In general, such "strong" factors as age, education, health, and sensory and functional limitations have similar effects on cognitive impairment of Mexicans in the U.S. and Mexicans in Mexico, but there are differences in the effects of social factors on cognition in the two populations.

Qian Xiong and Dudley Poston in Chap. 13, "The Urban Hierarchies in China and the United States," first introduce and discuss the concept of the "urban system" and review its initial development in the mainly Western literature on metropolitan dominance and integration. Then using data from the *2012 China City Statistical Yearbook* and from the U.S. *2012 Economic Census*, they configure quantitatively the urban systems of China and the United States as of 2012. They compute metropolitan dominance scores for each of China's 177 large cities, and for each of the 69 large cities of the U.S. Their results show that Beijing is the most dominant city in China, although not the largest in population, and is followed closely by Shanghai. And New York City is the most dominant city in the U.S. Beijing and Shanghai in terms of their dominance in China are comparable to New York City in terms of its dominance in the United States. Key findings of their research are the demonstration that the dominance of a city is not purely determined by its population size or administrative role, and that there is a hierarchical relationship in the urban system.

Matthew Martinez, in Chap. 14, "School District Formation as an Explanation for Spatial and Temporal Dimensions of Concentrated Poverty in Bexar County, Texas," investigates the social impact of school district fragmentation in Bexar County, Texas (which is largely the City of San Antonio). Using a socio-historical analysis, Martinez first shows how school district formation in the county reified persistent and concentrated neighborhood poverty. He next asks whether school district consolidation should be considered within the framework of ending cycles of persistently concentrated neighborhood poverty. He shows that Bexar County has a history of place-based educational and economic disparities between school districts. Most high-poverty neighborhoods in the county have had high poverty for the entire period 1970–2000. And it is in those neighborhoods where school dropouts are the highest. He argues that the stubborn nature of concentrated high neighborhood dropout rates should be on of great concern for policy creation in Bexar County due to the strong relationship that dropout rates have with neighborhood poverty.

In Chap. 15, "Union Formation Selectivity after Childbearing: Do Local Marriage Markets Matter?", Gabriela Sánchez Soto focuses on the context of union formation after childbearing, with a special focus on the role of local marriage markets.

Understanding the processes in which single parents enter new unions is essential for understanding outcomes for their children and their families. Two explanations for the role of marriage markets on the union formation of single parents are marriage selectivity and marital search theory. Her findings show that marriage markets play different roles in the types of families that men and women form. Although step-families are only a small proportion of all unions formed, men are more likely than women to enter step-families either through marriage or cohabitation. Her findings show further that while socioeconomic characteristics of the respondents do not always have a significant effect, the characteristics of the partner/spouse do matter, especially for women.

Early in Chap. 16, "Minority Student Participation in International Programs: A Survey of Undergraduate Students Attending HBCUs," Komanduri Murty notes that there has been and continues to be an underrepresentation of minority students in study abroad programs. Hoping to better understand this underrepresentation, he analyzes in his chapter the findings of the national-based United Negro College Fund Special Programs (UNCFSP) web-based minority undergraduate student survey that was conducted in 2007. He finds that the participation levels of minority students in study abroad programs are low because of high costs and conflicting schedules. Some minority students appear to prefer completing necessary coursework for degree requirements before they take part in some of the international and study abroad activities. The research he reports in his chapter will hopefully encourage further analysis of minority students at HBCUs and their participation in international education and study abroad activities.

Angelica Menchaca and Dudley Poston analyze in Chap. 17, "Community Well-being and Mexican Interstate Migration in the United States," the interstate migration flows of Mexicans in the United States during the period of 2011–2015. They find that migration theories conceptualized with a classic gravity model and a human ecological model are appropriate and suitable for analyzing and understanding the effects of community well-being on the interstate migration flows of Mexicans. The main factors of state-level well-being that encourage Mexican migration at both origin and destination are shown to be the proportions of Hispanics at origin and destination, and whether or not the states are classified as punitive. Their research indicates that more work is needed especially with respect to the development of the ecological model of migration and the employment of a wider body of factors of community well-being.

In Chap. 18, "Family Values at Work in the Mississippi Delta: Effects of Marriage and Employment on Well-Being of TANF Participants," Marlene Lee, Joachim Singelmann, and Lena Etuk address the consequences of the 1996 welfare reform legislation. The aim of that legislation was a reduction of welfare care loads by moving women on public assistance to employment through a mix of incentives and sanctions. Marriage was seen as another path to move people from welfare, assuming that two incomes would lift a family out of poverty. However, using simulation models, the authors find that employment has a stronger effect on the reduction of TANF caseloads and poverty than does marriage, although the relative effects of employment and marriage are reversed in rural areas.

Chapter 2
What's Changing the World? A Demographer's Perspective

Wendy Baldwin

2.1 Introduction

Population growth around the world between now and 2100 will be led by developing countries. Over 75% of the growth will occur in developing countries. And the fastest growing regions will mainly be those in sub-Saharan Africa. This growth differential will be important to keep in mind in my discussions below of trends and projected trends in non-communicable diseases.

Many countries have lowered their fertility rates, improved their levels of educational attainment and increased their control over infectious diseases. These are good signs for the health and productivity of their populations. However, many of these countries now face a growing impact from non-communicable diseases (NCDs). In this chapter, I focus specifically on trends and patterns in non-communicable diseases in the regions and countries of the world, now and in the future.

There has been a shift in past decades from infectious to non-communicable diseases in many countries, and this shift will accelerate in the coming years. NCDs in low and middle income countries occur at earlier ages than in wealthier countries. The earlier onset means that these diseases will also lower economic productivity.

The four major NCDs, namely, cardiovascular disease, diabetes, most cancers, and chronic respiratory disease, share four underlying, modifiable behavioral risk factors, namely, tobacco, excessive alcohol, poor diet, and low levels of physical activity. This means that the potential burden of NCDs can be lowered by addressing behavioral risk factors now.

Adolescence provides an opportunity to do this. The often high and generally rising levels of adolescent health risk behaviors is a call to act now to support a healthier, more robust future. I discuss this issue later in the chapter.

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2.2 The Rising Burden of Noncommunicable Diseases

There is a fairly clear picture about population global growth for the foreseeable future. I have shown above in Fig. 2.1 that the more developed countries will contribute little to that growth in the decades ahead, while the less developed countries will continue to grow, albeit likely at a slower pace than has been true in the past. This is a reflection of the demographic transition which has taken countries from high fertility and mortality rates, and slow population growth, to falling death and birth rates, and typically population growth, to finally a stage of low fertility and mortality rates, and slow population growth, that are observed in most of the more developed regions of the world where population levels are generally stable.

There are many dimensions to this population picture, but one that has clear implications for possible interventions is the changing pattern of health, disease and mortality in the less developed countries. But, it is not only the just mentioned demographic transition that writes the script for a country's future. Most developing countries are at the cusp of the epidemiologic transition. This is a transition from high levels of infectious disease and maternal/infant mortality to one where mortality is dominated by non-communicable diseases, where mortality is low and life

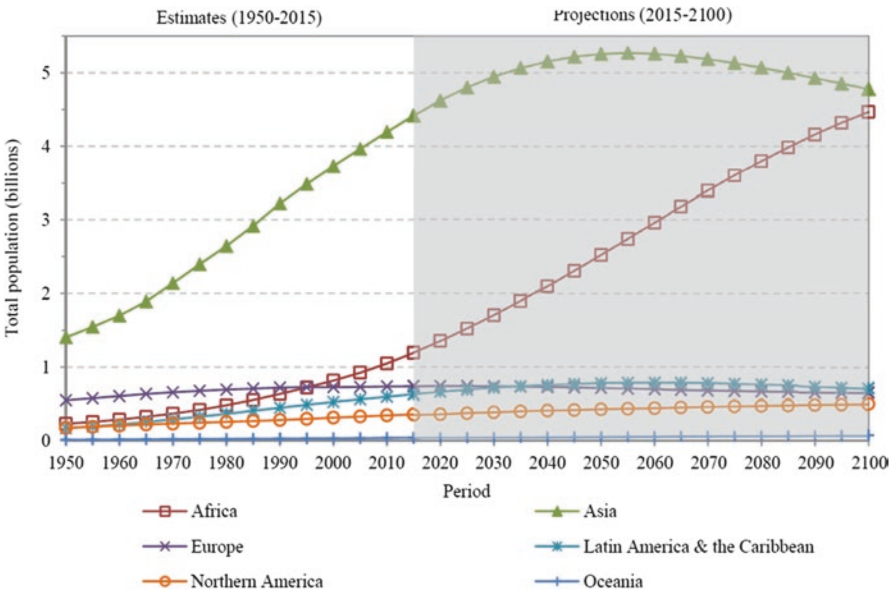

Fig. 2.1 Population of the regions of the World: 1950 to 2015; and 2015 to 2100 (Source: United Nations, Department of Economic and Social Affairs, Population Division (2017). *World Population Prospects: The 2017 Revision*. New York: United Nations)

expectancy is high. This latter stage now characterizes much of the world, especially the developed countries.

But it is the transition state per se that should concern us today (Omram 1971). The process of going from a high burden of infectious disease to a situation of non-communicable diseases might seem like an inevitable process and one where the debate is about which diseases will affect the elderly. While the picture is more complex, it is one laden with hopeful opportunities.

There are many encouraging signs in the developing world, from lowered fertility and mortality levels, and increased school enrollment, especially for girls. This has led many countries to have a growth in their youth populations. A large number of young people can be an economic engine if other conditions are also met (Gribble and Bremner 2012). Another reason to look at these large populations of young adults is their implication for the future health of the population. Behaviors adopted during adolescence and young adulthood will also shape the future health picture for individuals and their countries.

Young people are often given little attention in the discussion of the burden of health, except for sexual and reproductive health. Their health tends to be good, they are minimal users of health services, and their mortality rates are low. However, health behaviors during youth often set the stage for what they and their communities will face in the future (Baldwin et al. 2013a). We could simply look at their disease profiles during adolescence, but it would be better to ask what the future is likely to bring as countries move through the epidemiologic transition.

The globe has been riveted, and rightly so, on the burden that communicable diseases create. And, while there are many such diseases, the emphasis has been on a few, such as AIDS, malaria, tuberculosis, and the "newcomer," Zika, that takes a large toll. There are many non-communicable diseases, but the global health interests have identified the four I have already mentioned, that represent 80% of the burden. These are cardiovascular disease, most cancers, diabetes, and chronic respiratory disease. The World Health Organization has focused on these four which also share four underlying behavioral risk factors (WHO 2011). This focus makes looking at potential interventions much more manageable.

While the focus here is on the rising burden of NCDs and the risk factors that lead to them, this does not mean that infectious diseases have been conquered or that they can be ignored. Far from it. Infectious diseases still present huge burdens where no clear prevention is available and/or where treatment is hugely demanding and often expensive. But, just because there is still a burden from infectious disease does not mean that the burden of non-communicable disease is not rising as well. Countries can, and do, face a "double burden" of disease (Kolcic 2012).

Non-communicable diseases already dominate the mortality patterns of the wealthy countries, accounting for almost 90% of all deaths (Nikolic et al. 2011) (see Fig. 2.2). And they are the predominant cause of death in other regions with the exception of sub-Saharan Africa. Even there, the proportion of deaths to non-communicable diseases will reach almost half of all deaths by 2030. In other areas, such as south Asia, the percentage will likely rise from over 50% to over 70%. In their 2011 report, the Institute for Health Metrics and Evaluation identified five

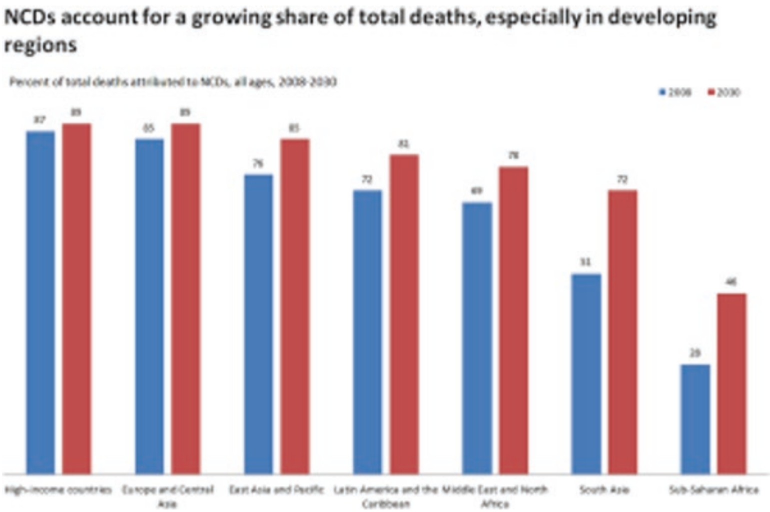

Fig. 2.2 Percent of deaths due to non-communicable diseases: regions of the World, 2008 and 2030. (Source: Nikolic et al. 2011)

major challenges for the future: the demographic transition/longer lifespan, the cause of death transition to NCDs, the global shift to disability as opposed to mortality, the changing risk factor to behavioral risks, and health systems facing enormous challenges (IHME 2013). The different NCDs will grow in importance, country by country.

But deaths from NCDs tell only part of the story, since the timing of death is also important. Only 13% of NCD deaths in wealthy countries occur to individuals under the age of 60. But it is almost 30% in low and middle income countries. These earlier deaths are occurring at times when individuals are still the mainstays of their families and are economically productive. Also, many of the NCDs are preceded by periods of disability which can have disastrous effects on families when a breadwinner is incapacitated (WHO 2011). In India, for example, one-half of all heart attacks in the population occur to persons before age 50, and 25% of them to persons before age 40 (Vyas 2012) (Fig. 2.3).

Many NCDs have medical precursors that can be addressed through medication, such as hypertension or high cholesterol. Some of these diseases can be managed medically and may be able to forestall other adverse health events. But medical management, or secondary prevention, requires a health system that can screen, diagnose and treat (for life) large segments of the population. This is an enormous undertaking, especially for health systems that are still dealing with infectious diseases and maternal/child health demands. Primary prevention, while aimed at even larger segments of the population, can lower the risk factors and bring more than the health sector into the process of supporting a healthy and productive population for years to come.

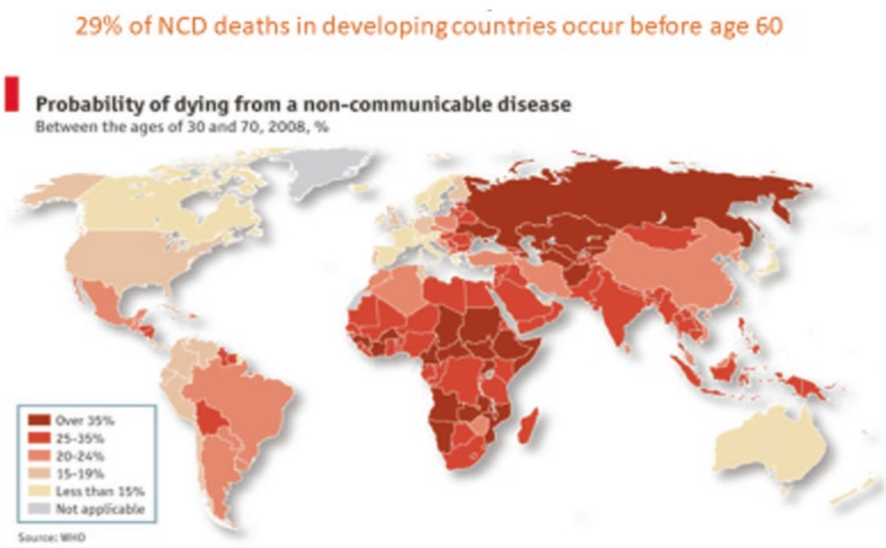

Fig. 2.3 Probability of dying from an NCD between the ages of 30 and 70, 2008

2.3 The Four Risk Factors that Account for Most NCDS

I now move to the optimistic portion of the chapter. There are four risk factors that account for about half of the risk for the four major NCDs. These are tobacco use, alcohol use, poor diet, and low physical activity (WHO 2011). The latter two typically combine to lead to the rising rates of overweight and obesity. To address the rising burden of NCDs we must look at the initiation of these risk factors, and this means looking to youth. Two of the risk behaviors begin during adolescence, namely, tobacco and alcohol. Also, for diet and exercise, adolescence is an ideal time to reinforce positive behaviors than can become lifelong habits.

There is modest evidence about adolescent risk behaviors for NCDs. Two data sources that provide comparable data for a number of low and middle income countries are the Global School-based Student Health Survey and the Global Youth Tobacco Survey. Each survey includes youths between the ages of 13–15 who are in school. This means that for the countries with low school enrollments, or biased enrollments on the basis of gender and/or ethnicity, the results will be less informative for the country as a whole. However, since school enrollment rates have been increasing, this may not be a major shortcoming. There are also some data available from the Demographic and Health Surveys; their primary focus is on reproductive health, but they include measures of obesity.

For tobacco and alcohol use, the best measure is "use in the past 30 days." Some surveys include measures of "ever used," but they may capture very limited or occasional use – or even one-time experimentation. Alcohol can be purchased or home brewed. Consumption is the key issue for risks to youth. Diet and physical activity are frequently presented together because they combine to represent energy balance. Dietary risk factors include the low consumption of fruits, vegetables, nuts, seeds and Omega-3 fatty acids, and the increased intake of salt and refined sugar, processed carbohydrates and unhealthy fats (Escobar et al. 2013).

What do data from these surveys tell us? What is the evidence? Tobacco use is substantial in many parts of the world, typically more so for boys than for girls (PAHO 2011). However, in some countries, the use rate among girls is quite high, and often increasing. In Chile, for example, 43% of girls aged 15–24 smoked one or more cigarettes in the last 30 days. By comparison, in the U.S., 20% of high school boys and 16% of high school girls reported smoking one or more cigarettes in the last 30 days. Some countries are beginning to show declines in smoking rates, but in others the rates are climbing. Also, the risks tend to be higher in urban areas (Baldwin et al. 2013b).

Surveys in Latin America document levels of alcohol consumption at around 47% for girls aged 13–15 in Jamaica and 48% for boys aged 14–17 in Argentina (Baldwin et al. 2013c). Other regions also show considerable variability. Rates are low in Muslim majority countries (Kaneda et al. 2014). By comparison, in surveys of U.S. high school students, the rates were 38% for girls and 40% for boys (Baldwin et al. 2013c).

Research in the U.S. shows an interesting pattern between the age of onset of drinking and later addiction. The early onset of drinking is related to high rates of addiction regardless of whether there is a family history of addiction. Concerns and interventions about alcohol use focus on the early adolescent years, even though the actual proportions of young people drinking tend to be lower at those ages (see Fig. 2.4).

Unhealthy diet and insufficient physical activity are a pathway to high blood pressure, overweight and obesity. Not surprisingly, type 2 diabetes, hypertension and heart disease are also likely outcomes. Data from Latin America and the Caribbean (LAC) show that most 13–15 year old girls do not meet physical activity guidelines; indeed the LAC region has the most serious problem with obesity

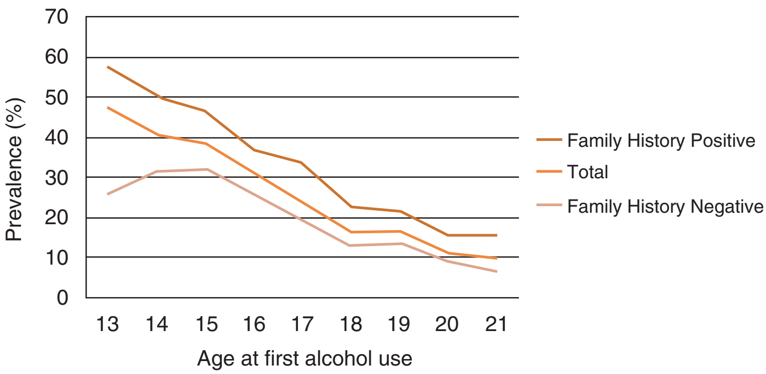

Fig. 2.4 Onset of alcohol use and alcohol dependence in the United States

worldwide. The region is highly urbanized, and urban living frequently leads to an unhealthy diet and reduced physical activity. Urban areas usually provide few opportunities for physical activities that are safe and appealing.

Many developing countries are still battling undernutrition and stunting, that is, children being short for their age. Thus it might seem odd that obesity is being raised as a problem for developing countries. However, it is possible to see both undernutrition and overweight/obesity occurring in the same country (Bolivia Ministry of Health 2009), and even in the same household. South Africa has both underweight and wasting among children and substantial obesity among adults (Kruger et al. 2012). In Egypt, one study showed that 15–25% of Arab children under five were stunted, and 5–15% were underweight. Among adults, 30% were obese, a level higher than in other Arab countries. In Egypt, 12% of stunted children have obese mothers (The Economist 2012). This points to deficiencies in nutrition in families where early malnutrition for the mother affects her metabolism which leads to excess storage of fat. Her food intake may change, but if micronutrients are lacking, obesity will follow. Among pregnant women, half are anemic as a result of an iron deficient diet.

It is hard to find children who are not physically active, but in many settings activity levels tend to decline during adolescence. Low levels of physical activity typically lead to a 20–30 increase in all cause mortality (Office of Disease Prevention and Health Promotion 2013). Young people need at least 60 min of physical activity every day. Data from Latin America indicate that most young people do not meet these guidelines for physical activity (Baldwin et al. 2013d).

While there are global standards for appropriate levels of activity, there are different ways to conceptualize the phenomenon. For example, one might count only the time spent explicitly exercising, but walking to school or work is also activity. Also, while it is true that some forms of work involve significant physical activity, others do not. In Colombia it was clear that youth could report on these different forms of activity, and that there were gender differences. Adolescent males who were employed were more likely to be in jobs that involve physical labor. In South Africa, a household survey of 15–24 year olds reported that 31% of the males noted they were physically inactive, compared to 47% of the females. In that population 10% of the males were overweight compared to 31% of the females (Steyn 2013).

The broad picture here is clear. NCDs are of growing concern in developing countries, but context is important. Some regions, such as Latin America, began their transition decades ago and others, such as Africa, are in the early stages (Popkin and Gordon-Larsen 2004). Some countries have strong gendered patterns of consumption of alcohol and tobacco such that interventions may need to consider ways to reach young males more so than females. On the other hand, many countries show greater risks for obesity among females. Some young males retain higher levels of physical activity because of the kinds of work they do, but as the nature of work changes with development, the young men will likely be exposed to the same lowered levels of physical activity that are seen in wealthier countries.

As countries develop, the patterns of risk may shift. In high income countries youth from lower socioeconomic groups have the highest levels of overweight and the lowest levels of physical activity. At the present time, youth in low and middle income countries are more likely to suffer from obesity if they are in the higher socioeconomic groups (Hanson and Chen, 2007). As countries advance economically, youth – and others – may move away from a lifestyle that includes a lot of physical activity and a generally healthy diet. Increased income may lead to lowered physical activity when work places fewer demands on the adolescents. The availability and appeal of shelf stable carbohydrates, sugar sweetened drinks, the use of unhealthy cooking oils, and less availability of fresh fruits and vegetables may erode healthy nutrition. In Ghana, more than half of the boys and girls usually drink carbonated drinks one or more times a day (Naik and Toshiko 2015). Perhaps NCDs should be called the diseases of development. No one would propose reducing or slowing down the progress toward development, but it may be time to address the likely changes that development can bring that are to the detriment of individuals, families, and nations.

What is being done to address these challenges? There are a number of initiatives that address the risk factors for NCDs although they are not specifically focused on youth. For example, one successful approach has been an increased tax on tobacco to raise the cost of smoking (Sylvain 2008; Jiménez-Ruiz et al. 2008). In countries where this has been tracked over time, a rise in taxes is clearly associated with a decline in consumption. The data for South Africa show a similar pattern to that seen in the U.S. and in Mexico. In South Africa there was a significant decline in cigarette smoking and an 800% increase in tax revenues after taxes were raised. Taxation is a general strategy, but it appears to have a greater influence on youth smoking. In some countries the gains from taxation are applied to broader public health programs, and in some cases specifically to anti-smoking programs (see Fig. 2.5).

Australia has launched a broad program to limit tobacco consumption, and many countries have laws against the purchase of tobacco by youth (NCD Child 2014).

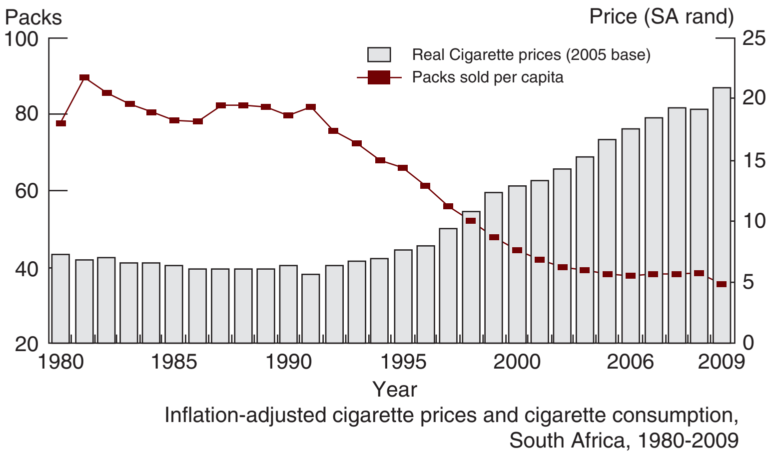

Fig. 2.5 Cigarette prices and consumption: South Africa, 1980–2009

However, taxation is a good starting place for the control of tobacco because it also generates funds that may be applied to other programs. A recent meta-analysis of the research literature on the impact of taxation of sugar-sweetened beverages shows that such taxation may reduce obesity although more research is clearly needed. This is a recognition that interventions outside the health sphere can also have an impact on health. And, in the case of taxation, the interventions may create a revenue stream (Escobar et al. 2013).

There are many opportunities for schools and communities to endorse healthy lifestyles, provide healthy foods in schools, and endorse youth-driven initiatives. Civil society can form partnerships to educate policy makers, the media and the public about the benefits of such initiatives. Social media can engage public figures who are popular with youth. Religious organization and other community based groups can sponsor programs that promote healthier lifestyles.

Many countries and communities have laws against the sale or consumption of alcohol by minors. It is important to consider not only the laws and policies that are in place but also the level and effectiveness of enforcement. As more families and communities become aware of the dangers of early and excessive alcohol consumption, enforcement may become more feasible.

2.4 Conclusion

The growing burden of NCDs in the developing world will challenge individuals, families, communities and nations. The impact of NCDs on health does not just affect the risk of death, but also the likelihood of disability. Disability not only takes away the individual's quality of life, but it also has an impact on their familes and society since it may affect their ability to work. The earlier onset of disease in the developing world compared to the more developed nations contributes to the impact of economic well-being. In high income countries only 13% of people under age 60 die of NCDs, whereas in low income countries the percentage increases to 29% (WHO 2011). The global economic toll of NCDs has been estimated at over $21 million in the low-and-middle-income countries over the period 2011–2030 (Bloom et al. 2011).

One area of synergy is between NCDs and sexual and reproductive health (SRH). Some of the risk factors are shared, and SRH services may be an entry point for interventions to support healthier behavior. For example, alcohol consumption can lower the likelihood of responsible sexual/contraceptive decision-making. Programs to reach youth with SRH services can also point to the benefits to them, and to their children, of their refraining from tobacco products. In Chile, 43% of females aged 15–24 smoked one or more cigarettes in the last 30 days.

The World Economic Forum's annual Executive Opinion Survey shows that about half of all business leaders surveys worry that at least one NCD will hurt their company's bottom line in the next 5 years with similar levels of concern in low, middle and high income countries. This is especially the case where the quality of healthcare, or the access to healthcare, is considered poor (Bloom et al. 2011). Many of the NCDs have medical regimens that can help slow the progress of disease. For example, medications can help control high blood pressure, cholesterol or blood glucose. However, screening, diagnosing and treating (for life) large segments of the population place extraordinary pressures on health systems. These secondary prevention approaches require not just the medications but ongoing medical monitoring.

As the World Bank has noted, the developing world cannot afford to treat their way out of the growing burden of NCDs (World Bank 2011). Prevention is a must, and prevention should start early. Adolescence provides a time period to focus attention and ensure that appropriate laws, policies, programs, and information are all available to build a healthy, strong population in the future.

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Part II
Methodological and Statistical Issues

Chapter 3
A Demographic Evaluation of the Stability of American Community Survey (ACS) Estimates for ACS Test Sites: 2000 to 2011

J. Gregory Robinson and Eric B. Jensen

3.1 Introduction

The American Community Survey (ACS) provides current estimates of the demographic, housing, and socioeconomic characteristics of the United States population. The ACS comprises the characteristic data formerly collected once every 10 years in the decennial census sample or "long form" (Hogan 2008). The reengineered 2010 Census included only the 100% or "short form" questions, e.g., those dealing with such characteristics as age, sex, race, Hispanic origin, and housing tenure. Similarly, the 2020 Census will only include the 100 percent items. The ACS collects a great deal more data than the decennial census. The ACS thus is a valuable resource for applied demographers. It is thus vital to understand the stability of the ACS estimates.

The initial design of the ACS included the production of three main ACS data products: annual estimates (1-year file), 3-year period estimates, and 5-year period estimates. Annual ACS estimates are produced for areas with populations over 65,000; 3 years of survey data were pooled to produce estimates for places between 20,000 and 65,000; and 5 years of data are used to produce estimates for areas with a population below 20,000, including census tracts and block groups (Beaghan and Weidman 2008; U.S. Census Bureau 2008). In 2015, the Census Bureau discontinued the production of the 3-year file and associated data products (U.S. Census Bureau 2016).

Whereas ACS data have been published for all states since 2000, the sample did not achieve its full sample size, of about three million addresses nationally, until 2005 (U.S. Census Bureau 2009). During the 2000–2004 period, only annual estimates were released for states and large counties and places. The first 3-year

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"multi-year" estimates were published in 2008; they were multi-year estimates for the period 2005–2007. And the first 5-year estimates for small areas, including tracts, were published in 2010; these were estimates for the period 2005–2009. Indeed, ACS data are still relatively new compared to the many decades of socio-economic data published from the decennial censuses from 1940 to 2000. In this chapter we will thus evaluate the demographic stability of the ACS estimates, especially for demographic subgroups such as race and Hispanic origin, over the period from 2000 to 2014.

While the quality of the ACS estimates for the total population has already been evaluated, very little analysis of the consistency of demographic subgroups of the population has been conducted, especially over a time series of several years (National Research Council 2007; National Research Council 2013; Swanson and Hough 2012). An important product of the census results is the categorizing of the demographic and socioeconomic data by race and Hispanic origin; these were the kind of data available in Census 2000. We need therefore an examination of the reliability of the ACS data for these same characteristics and population subgroups (Robinson 2008).

In this chapter, therefore, we will evaluate the demographic stability of ACS estimates from 2000 to 2014. We define stability as maintaining expected differentials between demographic groups for key indicators such as poverty and home ownership. While we would anticipate some fluctuations in these indictors over time as areas experience social and economic changes, our focus is on the consistency in trends between demographic groups. Our analysis will have three main research questions. First, how reliable are the ACS estimates for measuring the characteristic distribution of population and/or housing subgroups within any given year, e.g., 2005 or 2014? Second, do the differentials in the ACS estimates by race and Hispanic origin appear to be reasonable? Finally, are the measured differentials stable over time, e.g., from 2000 to 2014, and are they consistent with the census benchmarks? We will use county-level data from the ACS to address these research questions.

3.2 Data and Methods

While full implementation of the ACS did not begin until 2005, the materials we report in this chapter will include a time series of ACS estimates going back to 2000. The key source that enables this long time period is a special research file from the Multi-Year Estimates Study that was developed by the Census Bureau to evaluate the ACS 1-year, 3-year, and 5-year estimates in selected counties from 1999 to 2005 in advance of the official full-scale implementation. While the main multi-year products include characteristic profiles for the total population, this special file tabulates estimates for race and Hispanic origin groups at the county level. We will use a time series of ACS estimates from 2000 to 2014, including one-year and multi-year estimates, i.e., 3-year and 5-year, from the Multi-Year study for

2000–2004 and the regularly released one-year and multi-year estimates for 2005–2014; these estimates are updated on the Census Bureau's American FactFinder data tool every year.

In our evaluation, the ACS estimates are compared to the 1990, 2000, and 2010 Census benchmarks for each area, and the consistency of each estimate is assessed relative to the estimates for successive time periods, other demographic groups, and other geographic areas. The historical underpinning helps add context to the comprehensive review of the continuously emerging ACS data.

3.3 Characteristics for Evaluation

Our focus is on the ACS 1-year and multi-year estimates by race and Hispanic origin for two demographic measures, namely, the poverty rate and the percent of housing units that are owner occupied. The poverty rate is a key characteristic of interest. For instance, the Census Bureau news release that accompanies the first published ACS data every year leads with estimates on income and poverty. While prior research has focused on the stability of poverty rates for small areas over time (Schmertmann 2008), past research has not addressed the consistency of differential poverty rates from the ACS when the estimates are classified by race and Hispanic origin. The ownership rate is a demographic characteristic that generally does not change much over short intervals, so this variable is a good test of the ACS stability for race and Hispanic origin groups. We measure ownership rates as the percent of housing units that are owner occupied. In our analysis of the stability of the time series compared to expected trends, the change in the percent of the civilian population that are veterans will also be examined. The estimates for this variable will help visually summarize how the size of the population affects sampling variability and the stability of implied trends in ACS estimates.

3.4 Geographic Areas

The consistency of the ACS poverty rates and ownership rates are illustrated for selected geographies, including larger areas where both 1-year and 3-year multi-year estimates are available for the race/origin groups, and smaller areas where only the 5-year estimates are available, i.e., for population groups of less than 20,000. Three specific counties, or "case studies," are examined that represent the range of detailed data available to users in the fully implemented ACS. The first, Bronx County, New York is a large county in overall population size, and it has several race/origin subgroups of population 65,000 or more, such that 1-year estimates can be compared for each group (Salvo et al. 2007). The next, Multnomah County, Oregon is a medium size county, where most race/origin groups are less than 65,000, with the exception of non-Hispanic Whites. The 3-year estimates are required to make comparisons between groups due to the smaller population size. Upson County, Georgia, is a smaller county where only the 5-year ACS estimates are available in race detail. In addition, we will show results for Rockland County, New York and Schuylkill County, Pennsylvania, which are both metropolitan counties.

3.5 Time Series of Census and ACS Estimates

In all figures to be presented below, the 1990 and 2000 Census estimates are shown as the first two data points. These two estimates serve as both benchmarks to assess the ACS estimates and to establish race/origin differentials in the main characteristics, i.e., the poverty rate and the ownership rate for 1990 and 2000. The margin of error, based on a 90 percent confidence level, is indicated by the vertical error bars for the poverty rate, since this is a sample item. The ownership rate is a 100 percent item in the census, so sampling error is not applicable.

The 1-year ACS estimates for 2000–2014 are shown with connecting lines, as these data points do not overlap; see Fig. 3.1 for Bronx County. Using the Multi-Year Study estimates for 2000–2004, and the published ACS estimates for 2005–2014, fifteen data points are available to assess the stability of the annual ACS estimates.

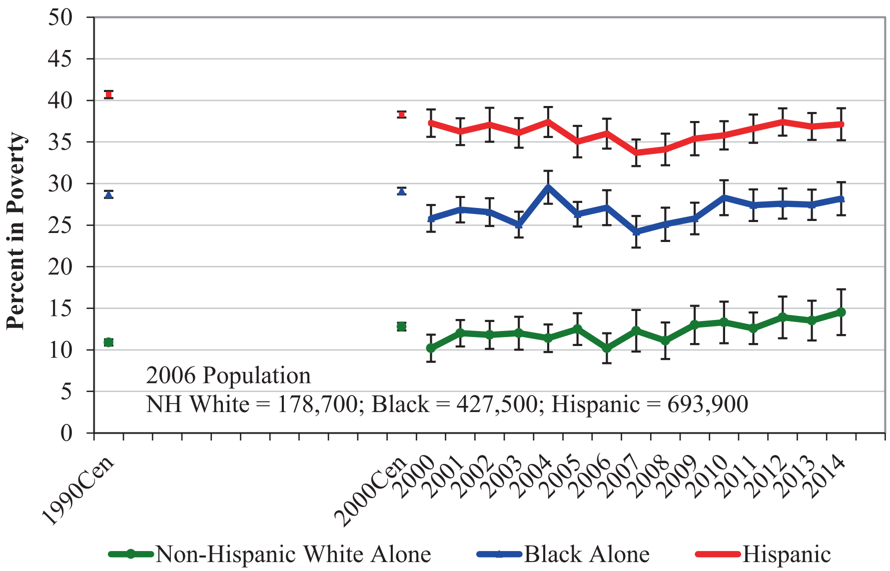

Fig. 3.1 Poverty rates for race/origin groups based on census data (1990, 2000) and 1-Year ACS Estimates, 2000–2014: Bronx County, NY
Note: The Black Alone category includes Hispanics
Source: Published data from the 1990 and 2000 census and the 2005–2014 ACS. Special tabulation of the 2000–2004 multi-year study estimates

The 3-year ACS estimates for 1999–2001 to 2009–2013 are connected with a dashed line, denoting that adjacent estimates, e.g., 1999–2001 and 2000–2002, 2008–2010, 2009–2010, and 2011–2013, contain overlapping data; see Fig. 3.3 for Multnomah County. The lines indicate overall trends based on these “moving averages.” Importantly, using the Multi-Year Study estimates and published ACS estimates, five “non-overlapping” estimates are available to study the implied trend in the multi-year estimates, e.g., 1999–01, 2002–04, 2005–2007, 2008–2010, 2011–2013. With the published ACS 3-year estimates on American FactFinder, three “non-overlapping” periods are also available, e.g., for 2005–2007, 2008–2010, and 2011–2013. While the Census Bureau suggests that only non-overlapping estimates be used to measure change with the ACS, we include all the data files in our analysis in this chapter for illustration purposes.

The 5-year ACS estimates used are unique in that they allow the comparison of several non-overlapping estimates, e.g., 2001–2005 to 2006–2010 and 2005–2009 to 2010–2014; see Fig. 3.6 for Upson County, GA. Non-overlapping ACS estimates from American FactFinder were not published until 2015 for the 2010–2014 estimates.

In the 2000 Census and ACS, the race groups shown in the figures refer to the race “alone” population, that is, the estimate is for the population reporting only that race, e.g., non-Hispanic White alone, Black alone, Asian alone, and not those reporting that race and other race groups as well. For reference, the 2006 population estimate is given for each demographic group because 2006 is relatively close to the “midpoint” of the 2000–2014 span of ACS estimates.

The poverty rates for the published 1990 and 2000 Census data, and for the 2006–2014 ACS data, pertain to the resident population, while the ACS poverty rates for 2000–2005 are based on the household population. Thus some of the “disconnect” between the Census 2000 and ACS rates for 2000 or 1999–2001 are associated with this universe difference. The household population represents over 97 percent of the total population for all groups shown in the figures except for two instances, namely, 93 percent for non-Hispanic Whites and 96 percent for Blacks in Bronx County. The census and ACS universes for the homeownership rates do not differ; both pertain to all occupied housing units.

3.6 Results

The figures and data that we present will provide visual examples of how the demographic stability of the 1-year, 3-year, and 5-year ACS estimates for selected test site counties can be assessed on a time series basis, including comparisons to the 1990, 2000, and 2010 Census benchmarks, for demographic groups such as race and Hispanic origin. For the counties in this case study, the graphs illustrate the general stability of the differential poverty rates and ownership rates based on the ACS estimates within each period and compared to the census benchmarks.

3.6.1 Bronx County, New York: Annual ACS Estimates

Bronx County has a population or more than one million, and the population of every demographic group shown in Fig. 3.1 is at least double the 65,000 population threshold for annual ACS estimates. Perhaps the most notable observation is the consistency of the differential poverty rates and ownership rates of Blacks, Hispanics, and non-Hispanic Whites in each period (2000–2014), and the agreement with the differentials observed in the previous two Censuses of 1990 and 2000. For example, the poverty rate in Fig. 3.1 is highest for Hispanics in all years, 37% in 2014, and significantly higher than the rate for Blacks, 28% in 2014. The poverty rate of non-Hispanic Whites, 14% in 2014, is well below that of Hispanics and Blacks.

Longstanding differentials in the ownership rates are consistently observed as well for Bronx County, though in reverse order, that is, the highest rates are for Non-Hispanic Whites and the lowest rates are for Hispanics (Fig. 3.2). Within each demographic group, there is some instability in the year-to-year change in the ACS percentages. Some of this fluctuation could be "real," but it may also be due to sampling variability. Neither the poverty rates nor the ownership rates in the Bronx exhibit much trend since 2000, and few of the year-to-year changes are statistically significant. The stability of the time series of estimates across the years would be improved by using 3-year or 5-year estimates; this is related to the reduction in the margins of error for each "point" estimate using the multi-year files.

With the elimination of sample data, i.e., the "long form" data in the 2010 Census, the socioeconomic characteristics from the ACS can no longer be compared to a current census to assess consistency. But the ownership rates are available from the 2010 Census as a 100 percent item, however, so thus a direct benchmark comparison can be made. In Fig. 3.2 we see that, with one exception, the ACS estimates for Bronx County for each demographic group are not statistically different than the "benchmark" census percentages. The exception is the 2010 estimates for non-Hispanic Whites, the group with the smallest population of the three shown.

3.6.2 Multnomah County, Oregon: 3-Year ACS Estimates

While the total population of Multnomah County is large, over 650,000 residents, the population for Asians of 41,000 in 2006 is below the 65,000 threshold for 1-year ACS estimates and only slightly above for Hispanics, 69,000 in 2006. To minimize the impact of sampling variability, the 3-year ACS estimates become the appropriate data set to compare demographic groups. This situation of some subgroups being below 65,000 even though the total population is large, is more typical than the case of the Bronx where all groups were relatively large and annual estimates are available.

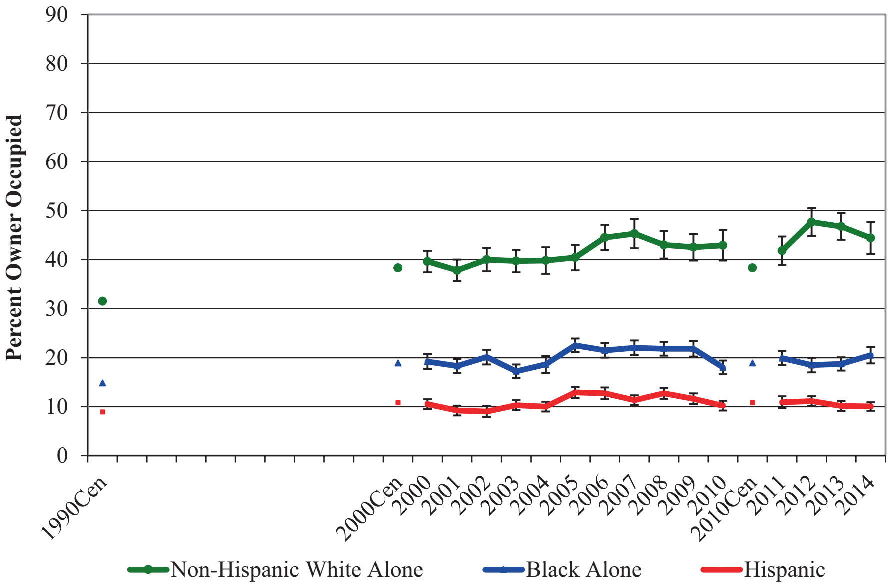

Fig. 3.2 Percent owner-occupied units for race/origin groups based on census data (1990, 2000, and 2010) and 1-Year ACS estimates, 2000–2014: Bronx County, NY
Note: The Black category includes Hispanics
Source: Published data from the 1990, 2000, and 2010 census and the 2005–2014 ACS. Special tabulation of the 2000–2004 Multi-Year Study estimates

For Hispanics and for non-Hispanic Whites, the large and statistically significant differential between the two groups in poverty rates (Fig. 3.3) and ownership rates (Fig. 3.4) is consistently measured in each period of 1999–01 to 2011–13. Moreover, it agrees with the differentials observed in the decennial Censuses of 1990, 2000, and 2010. The ACS poverty rates and ownership rates of Asians and non-Hispanic Whites show much less difference, mirroring the pattern in 2000 in poverty rates and ownership rates, and in the 2010 Census in ownership rates.

Unlike the case study of the Bronx, the poverty and ownership rates in Multnomah County do exhibit more fluctuation in the post-2000 period as measured by the ACS, even though few of the period-to-period differences are statistically significant. For these time series comparisons, we focus on the non-overlapping estimates (with large markers). The poverty rates in the county (Fig. 3.3) rose in the period from 2000–02 to 2003–05 for all three groups. The rates fell off in 2006–08 for non-Hispanic Whites and Asians, and rose again in 2008–10 and 2009–11; this corresponds with the economic recession. The trend for Hispanics showed a continuous increase in the poverty rate from 2007–09 to 2011–13.

The ownership rate (Fig. 3.4) trended upward across the 2000–02 to 2006–08 period; the higher rate in the last period is statistically significant for all demographic groups. The ACS measures a strong decline shared by all groups since 2006–08, as the percent of homeowners in 2009–11 is significantly lower than the

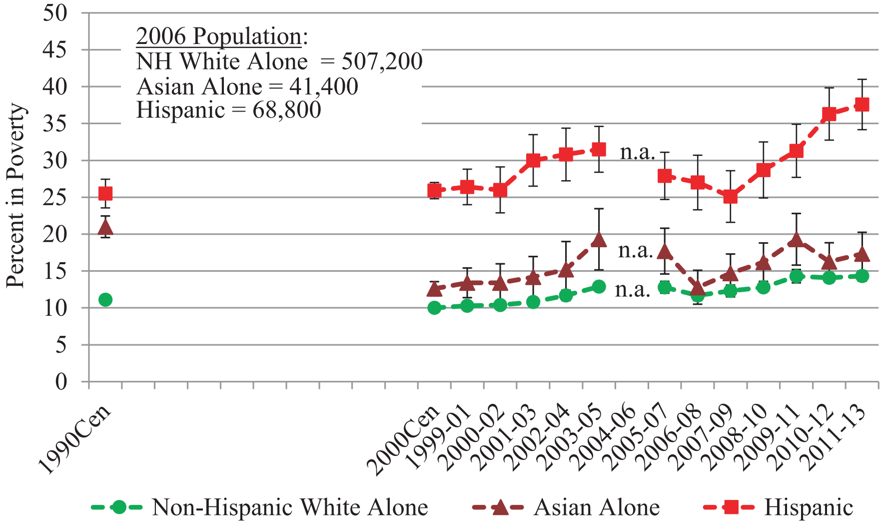

Fig. 3.3 Poverty rates for race/origin groups based on census data (1990 and 2000) and 3-Year ACS estimates, 2000–2013: Multnomah County, OR
Note: ACS 3-year estimates are not available for the 2004–06 period. The Multi-year Study estimates extended to 2003–05 and the first 3-year estimates reflecting full implementation started with 2005–07. The Asian Alone category includes Hispanics
Source: Published data from the 1990 and 2000 Census and the 2005–2007 to 2011–2013 ACS. Special tabulation of the 1999–2001 to 2002–2004 multi-year study estimates

"peak" percentages in 2006–08. The decline in home ownership coincides with the economic recession during this period. The 2010 Census results were also less than the ACS peak values of 2006–2008, and were closer to the ACS 2009–2011 values.

3.6.3 Upson County, Georgia: 5-Year ACS Estimates

For Upson County, Georgia, the 5-year ACS estimates are the standard of comparison; the demographic groups here are all less than the 20,000 threshold for 3-year estimates; the non-Hispanic White population is 19,000; the Black Alone is 7,600 in 2006. In fact, over one-third of U.S. counties, and over 90% of places, have populations less than 20,000; thus the 5-year estimates can be considered the "core" ACS data set. For the 5-year ACS estimates, the differential poverty rates (Fig. 3.5) and ownership rates (Fig. 3.6) of Blacks and non-Hispanic Whites are consistently measured in each of the periods of 1999–2003, 2001–2005, 2006–2010, and 2010–2014, and they agree with the differentials observed in the censuses of 1990, 2000, and 2010. The poverty rates of Blacks are significantly higher than for non-Hispanic Whites, and the ownership rates are significantly lower.

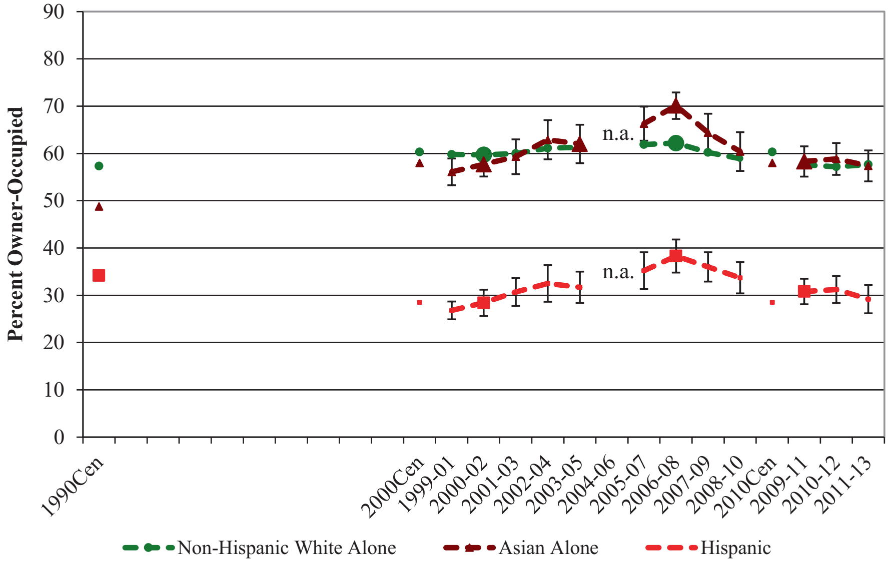

Fig. 3.4 Percent owner-occupied units for race/origin groups based on census data (1990, 2000, and 2010) and 3-year ACS estimates, 2000–2013: Multnomah County, OR
Note: ACS 3-year estimates are not available for the 2004–06 period. The multi-year study estimates extended to 2003–05 and the first 3-year estimates reflecting full implementation started with 2005–07. The Asian alone category includes Hispanics
Source: Published data from the 1990 and 2000 census and the 2005–2007 to 2011–2013 ACS. Special tabulation of the 1999–2001 to 2002–2004 multi-year study estimates

The margin of error can be large, even for the 5-year estimates, and this has an effect on the ability of the ACS to measure statistically significant change for the demographic groups. For example, while the poverty rate of Blacks in Upson County rose from 27.5 percent in the 2001–2005 period to 37 percent in 2006–2010, the two rates are not statistically different. Likewise the narrowing of the difference in the poverty rates of Blacks and non-Hispanic Whites from 2006–2010 to 2010–2014 is not statistically significant either. The ACS data can become "noisy" as the sample size becomes small, and the identification of trends may require a longer time series and knowledge of the area.

3.6.4 Asian Population: Comparison of 5-Year ACS Estimates across Counties

The previous case studies have examined the stability of the ACS estimates for demographic groups within specific counties. But the ACS and census data are also often used to make comparisons across counties. Figure 3.7 examines the

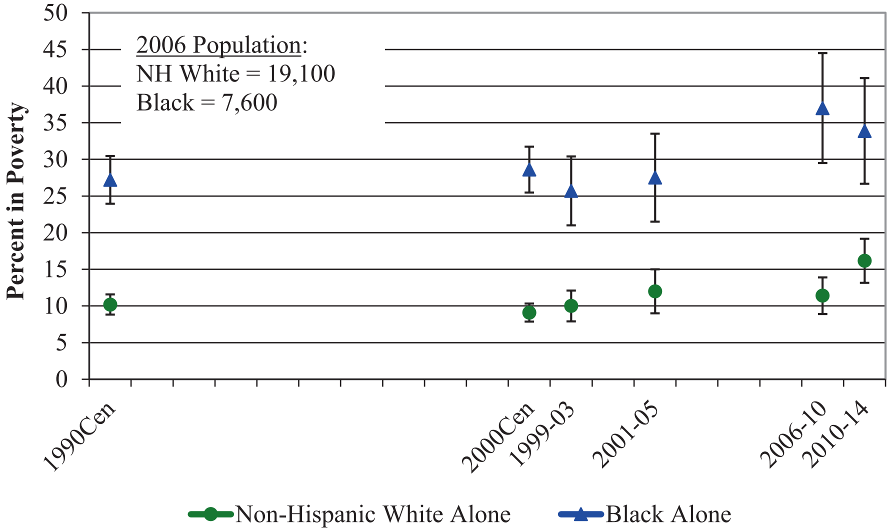

Fig. 3.5 Poverty rates for race/origin groups based on census data (1990, 2000) and 5-year ACS estimates (1999–2003 to 2010–2014): Upson County, GA
Note: The black cateogory includes Hispanics
Source: Published data from the 1990 and 2000 census and 2006–2010 and 2010–2014 ACS. Special tabulation of the 1999–2003 to 2001–2005 multi-year study estimates

reasonableness of the ACS 5-year estimates in three counties where the poverty rates differ appreciably for the Asian population; the counties are Bronx, NY; Multnomah, OR; and Rockland, NY. The geographic ordering is consistently measured, i.e., 1999–2003, 2001–2005, 2006–2010, 2010–2014 estimates, with relatively high poverty rates for Asians in Bronx County, intermediate rates in Multnomah County, and lower poverty rates in Rockland County. The rank ordering is the same as measured in the 1990 and 2000 Censuses. The differences in the poverty rates between the counties are statistically significant.

We show in Fig. 3.8 that these observations also apply to the differential patterns of ownership rates for Asians in the three counties, where the pattern of differentials is like the poverty rates, though in reverse order. The ownership rates are highest for Asians in Rockland County, intermediate in Multnomah County, and relatively low in Bronx County. Like the 5-year estimates for the demographic groups in Upson County, the margin of error is relatively wide for the Asian estimates. The differences in the poverty and ownership estimates for 2006–2010 and 2001–2005 are not statistically significant, with one exception, namely the Asian ownership rates increased in Rockland, NY.

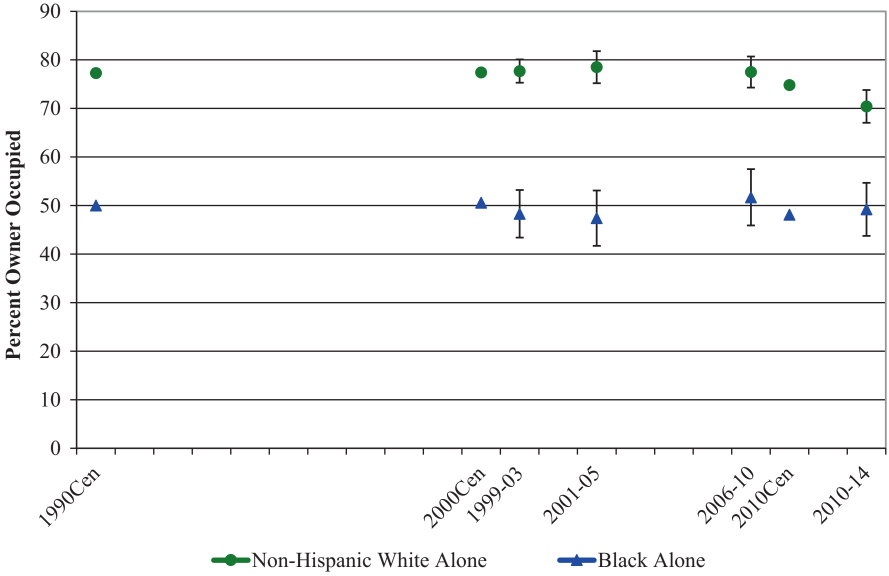

Fig. 3.6 Percent owner-occupied units for race/origin groups based on census data (1990, 2000, and 2010) and 5-year ACS estimates (1999–2003 to 2010–2014): Upson County, GA
Note: The Black Alone category includes Hispanics
Source: Published data from the 1990, 2000, and 2010 census and 2006–2010 and 2010–2014 ACS. Special tabulation of the 1999–2003 to 2001–2005 multi-year study estimates

3.6.5 Signal from the Noise

The stability of the measured year-to-year change in the annual ACS estimates varies by the size of the sample. Figure 3.9 illustrates this by comparing the percent of the civilian population 18 and older who are veterans for the United States, Pennsylvania, and Schuylkill County, Pennsylvania. Although the veteran population consists of former military personnel from all periods of service, veterans from the Vietnam era, Korean War, and World War II made up 56.2% of this population in 2010 (U.S. Census Bureau 2014). Given the increasing number of deaths as this population ages, the percent veterans is generally expected to trend downward each year, as is reliably measured by the 1990 and 2000 censuses and the 2000–2014 ACS estimates for the United States and Pennsylvania. However, note the "bouncy" ACS estimates for Schuylkill County where the population aged 18 and older equals 119,000 in 2006; the ACS estimates are clearly demographically implausible in depicting the annual change in the veteran population in Schuylkill County.

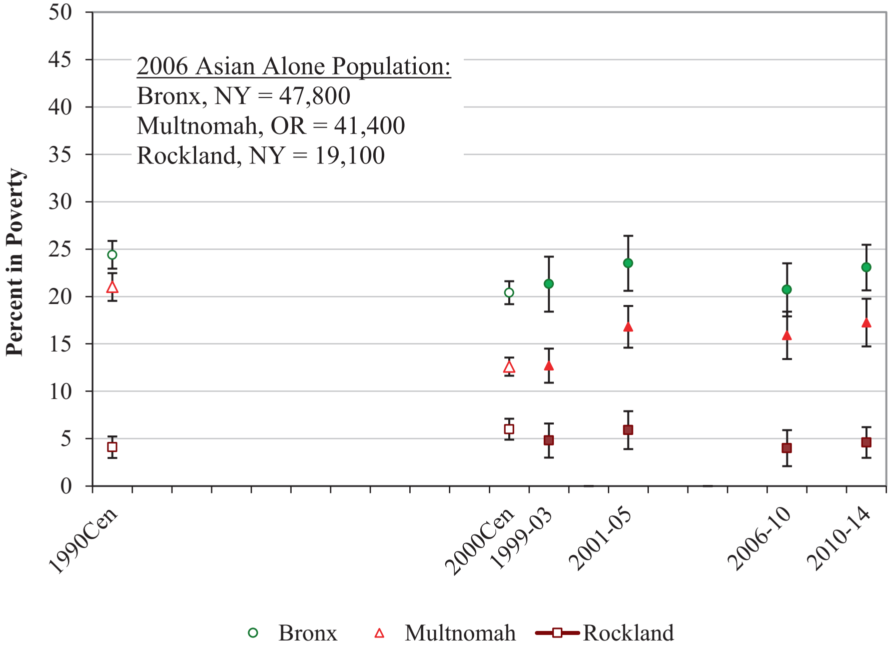

Fig. 3.7 Poverty rates for the asian alone population for selected counties based on census data (1990, 2000) and 5-Year ACS Estimates (1999–2003 to 2010–2014)
Note: The census data are outlined symbols while the ACS data are closed symbols
Source: Published data from the 1990 and 2000 census and the 2006–2010 and 2010–2014 ACS. Special tabulation of the 1999–2003 to 2001–2005 multi-year study estimates

The stability of the measured trends over time is clearly a function of the size of the population. In the case of Schuylkill County, which is near the 1-year ACS threshold of 65,000 for annual estimates, the use of multi-year estimates, e.g., 3-year period or 5-year estimates, has the effect of smoothing out the "noise" and revealing the "signal" of downward moving percentages.

Despite the volatility of the 1-year ACS estimates in measuring annual change for Schuylkill, note that the distributional focus, that is, proportionally more veterans in the county than the nation, holds in every year. This is similar to the greater stability of the measured differential poverty and ownership rates between demographic groups in any period than the consistency of the estimated change between periods within a given group.

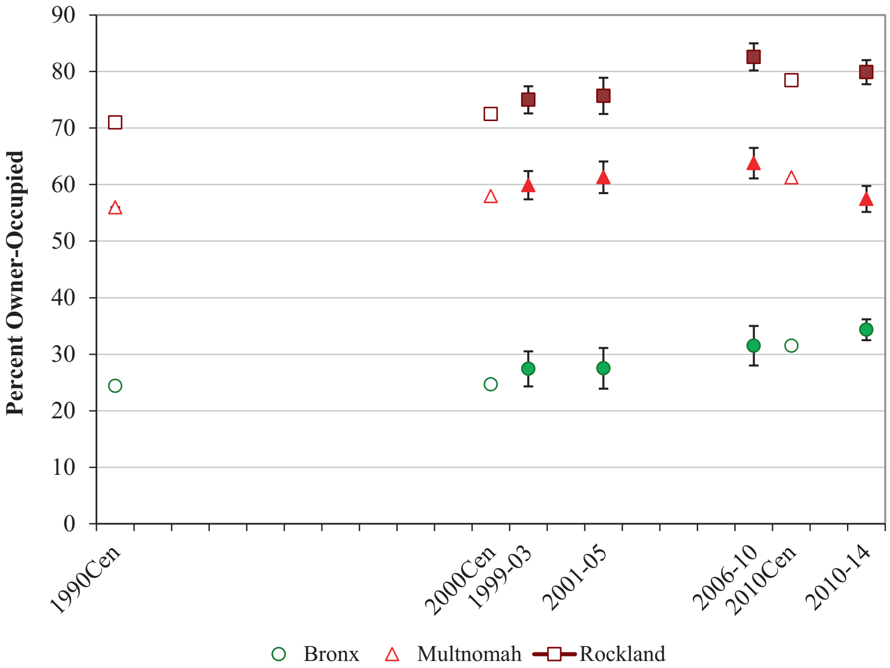

Fig. 3.8 Ownership rates for the Asian alone population for selected counties based on census data (1990, 2000, and 2010) and 5-year ACS estimates (1999–2003 to 2010–2014)
Note: The census data are outlined symbols while the ACS data are closed symbols
Source: Published data from the 1990 and 2000 Census and the 2006–2010 and 2010–2014 ACS. Special tabulation of the 1999–2003 to 2001–2005 Multi-year study estimates

3.7 Conclusion

The material presented in this chapter provide useful case studies of the reasonableness of a time series of ACS estimates, classified by race and Hispanic origin, at the county level. In addition to the decennial census results for 1990 and 2000, the Multi-Year Research File and other ACS data for race/origin groups provide a basis for evaluating a long span of ACS estimates, from 2000 to 2014. This data set allows the comparison of non-overlapping 5-year ACS estimates and up to five non-overlapping 3-year ACS estimates.

The purpose of our analysis was to illustrate the demographic stability of the ACS estimates over time. Estimates were considered stable when differences between demographic groups were maintained over time. The examples focused on

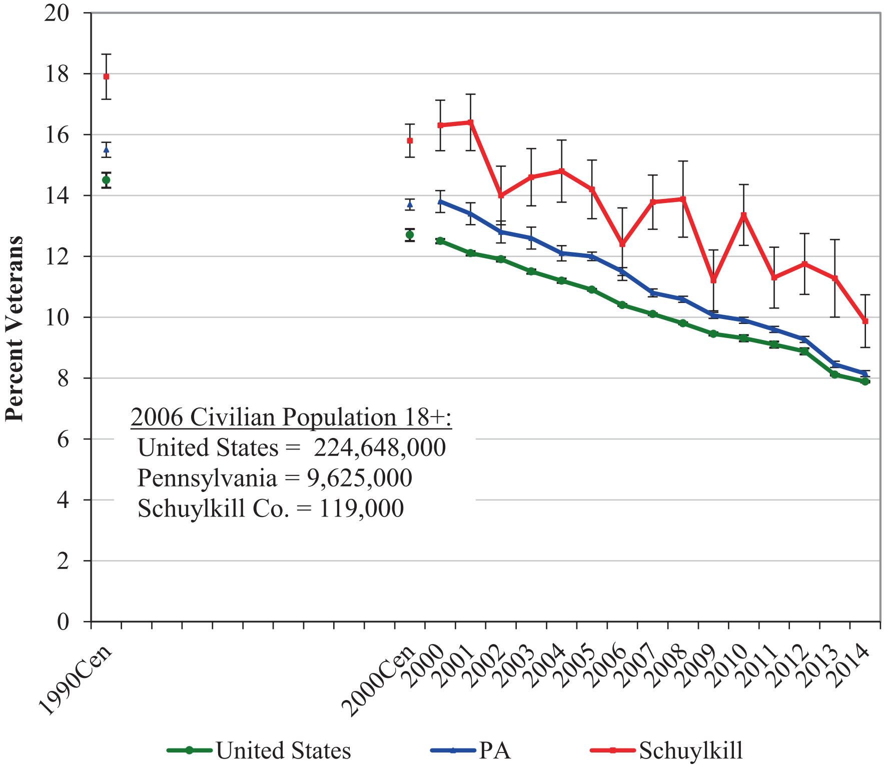

Fig. 3.9 Percent of the population who are veterans based on census data (1990, 2000) and 1-Year ACS estimates, 2000–2014: United States, Pennsylvania, and Schuylkill County, PA
Source: Published data from the 1990 and 2000 census and the 2000–2014 ACS 1-year files

the differentials in the poverty and ownership rates for race and Hispanic origin groups, and examined the consistency of the ACS estimates since 2000 compared to benchmarks from the 1990 and 2000 censuses. For the counties examined here, the differential poverty and ownership rates were consistently estimated by the ACS in each period and agreed with the differentials seen in the decennial results.

However, the trends over time for the poverty and ownership rates within each demographic group were less stable, with fluctuations from year to year associated with sampling variability. The wide margins of error for the 5-year estimates may make it difficult to assess the statistical significance of change for subgroups with relatively small populations, such as in Upson County. These examples of the stability of the ACS estimates for population subgroups can be expanded to systematically analyze more areas for more characteristics, and provide additional summary measures of consistency, such as the coefficient of variation.

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Chapter 4
Approaches for Addressing Missing Data in Statistical Analyses of Female and Male Adolescent Fertility

Eugenia Conde and Dudley L. Poston, Jr

4.1 Introduction

Missing data is a pervasive problem in social science research. Allison (2002: 1) has written that "sooner or later, usually sooner, anyone who does statistical analysis runs into problems with missing data. In a typical dataset, information is missing for some variables for some cases. … Missing data are a ubiquitous problem in both the social and health sciences … [Yet] the vast majority of statistical textbooks have nothing whatsoever to say about missing data or how to deal with it." Treiman (2009: 182) has noted that "missing data is a vexing problem in social research. It is both common and difficult to manage."

Researchers almost always have some missing data when undertaking their analyses; and the problem is usually difficult to manage properly. Many techniques have been developed to handle missing data, and some are clearly better than others.

This research uses data from the National Longitudinal Study of Adolescent Health (Add Health), a program project directed by Kathleen Mullan Harris and designed by J. Richard Udry, Peter S. Bearman, and Kathleen Mullan Harris at the University of North Carolina at Chapel Hill, and funded by grant P01-HD31921 from the Eunice Kennedy Shriver National Institute of Child Health and Human Development, with cooperative funding from 23 other federal agencies and foundations. Special acknowledgment is due Ronald R. Rindfuss and Barbara Entwisle for assistance in the original design. Information on how to obtain the Add Health data files is available on the Add Health website (http://www.cpc.unc.edu/addhealth). No direct support was received from grant P01-HD31921 for this analysis.

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Also, it is frequently the case that the results of a statistical model will differ depending on the method used to handle the missing data.

In this chapter we undertake two separate analyses, one for females and the other for males, of the likelihood of the respondent reporting having had a teen birth. We use several independent variables in our analyses that have been shown in prior studies to be important predictors of adolescent fertility. We handle the problem of missing data using several different approaches. We show in our analyses that depending on the method used, many of the independent variables in the sex-specific models vary in whether they are, or are not, statistically significant in predicting the log odds of a person having had a teen birth, and in the ranking of the magnitude of their relative effects on the outcome.

We first discuss the several mechanisms, as set out by Donald Rubin (1976, 1987), with respect to why data may be missing. We then review some of the major methods that have been developed to handle missing data, and we use eight of the methods to handle missing data in our separate models of adolescent fertility . We conduct our analyses using data from the The National Longitudinal Study of Adolescent Health (Add Health) (Harris 2008).

4.2 Mechanisms: Why Are Data Missing

According to Donald Rubin (1976, 1987), there are three main reasons or mechanisms for why data are missing; the data are either (1) "missing completely at random" (MCAR); (2) "missing at random" (MAR); or (3) "missing not at random" (MNAR).

Missing data are said to be missing completely at random (MCAR) when the probability of the missing data for a variable does not depend on the variable itself or on any of the other independent variables in the model. MCAR refers to the "condition in which missing responses to a particular variable are independent of the values of any other variable in the explanatory model and of the true value of the variable in question" (Treiman 2009: 182). If all the missing data in the model turn out to be MCAR, the data that are not missing are considered to be a subsample of the original sample.

Missing data are considered to be missing at random (MAR) if the probability of the missing data does not depend on the values of the variables with the missing data, after controlling for the other variables in the model. That is, MAR refers to "the condition in which missingness is independent of the true value of the variable in question but not of at least some of the other variables in the explanatory model" (Treiman 2009: 182). For example, given a data set with the three variables of age, marital status and income, with missing values on the income variable, the data would be considered MAR if the probability that income is missing is related to age and/or to marital status, but not to income. In other words, the missing data on income would not depend on, say, whether a respondent has low or high income. It is important to point out that there is no statistical test for determining if the data are MAR because, obviously, one cannot test whether there is a relationship between unobserved and observed data (Allison 2002).

Missing data are considered to be missing not at random (MNAR) when the MAR assumption is violated. The data would be MNAR if the probability that the values were missing depends on the variable itself. In the previous example, the data would be MNAR if the missingness of income depended on whether the respondent had a high or a low income.

4.3 Methods for Handling Missing Data

Statisticians have developed many methods for handling missing data. In this section we discuss several of the more prominent approaches. In a later section of the chapter we use each method separately in our two analyses of adolescent fertility.

4.3.1 Listwise Deletion

This is the method that is the default method in most statistical packages; it is also known as case deletion. The method of listwise deletion drops the missing values from the data set, and the analysis is then conducted using the reduced sample. We noted above that if the missing data are MCAR, the resulting smaller sample may be considered to be an unbiased subsample of the original dataset (Allison 2002). Consequently, in this situation the use of listwise deletion should result in models with unbiased estimates. However, the standard errors would tend to be a little larger because the sample size is now, obviously, smaller. With larger standard errors, statistical power will necessarily be reduced and the probability of finding significant results decreased; thus the listwise deletion method is often viewed as conservative provided that the MCAR assumption has been met (Acock 2005). But if the missing data are MAR and listwise deletion is used, then the estimates will most likely be biased (Allison 2002). However, Allison (2002: 7) has argued that, "… listwise deletion is not a *bad* method for handling missing data. Although it does not use all of the available information, at least it gives valid inferences when the data are MCAR… Multiple imputation is potentially much better than listwise deletion in many situations, but for regression analysis, listwise deletion is even more robust than these sophisticated methods to violations of the MAR assumption." Enders (2010: 55) has stated that listwise deletion should only be used when the "proportion of missing data is trivially small." However it is not at all clear what he means by "trivially small." For this reason we consider listwise deletion to be a useful albeit somewhat controversial method.

4.3.2 Mean Substitution

Mean substitution is a very simple approach. The missing values for a variable are replaced with the mean value for that variable. For example, if many respondents did not answer a question pertaining to their annual income, the mean value on the annual income question for those giving answers to this question is assigned to those persons not answering the question. One reason why this method is inappropriate is because subjects who do not answer a question on a variable often tend to be at the extreme ends of the distribution and should thus not be assigned the average score of the variable (Acock 2005; Enders 2010). Mean substitution has also been shown to be problematic when the percentage of missing values is large because this greatly reduces the variance and hence underestimates the correlation between the variable with missing values and any of the other variables in the model (Acock 2005; Allison 2002). Enders (2010: 43) has written that mean substitution "is possibly the worst missing data handling method available. Consequently, in no situation is [it] defensible, and you should absolutely avoid this approach."

4.3.3 Mean Substitution for Subgroups

A modification of mean substitution assigns the mean values for subgroups of the analysis. For example, a researcher might handle missing data on a variable such as income separately for the males and females in the sample by assigning to the males the average income value for males, and to the females the average income value for females. Although this approach will reduce the variance, it is considered to be only slightly better than substituting with the overall mean (Acock 2005).

4.3.4 Proxy Method

When researchers are confronted with lots of missing data on a theoretically important independent variable, they sometimes use the proxy method as a solution. That is, they substitute for the variable with the missing data another variable with little or no missing data, which variable is related substantively and statistically to the variable with the missing data. This method is not usually discussed in the missing data literature, but its use and application are endemic. For example, to address the situation of missing data on a variable such as income, some researchers (Vaquera 2006; Wahl 2010) have used educational attainment as a proxy for income (see Francis 2010; and Perreira et al. 2007, for other examples). At best this approach is a substitute solution to the problem and could well lead to model misspecification.

4.3.5 Dropping the Variable(s) with Missing Data

Occasionally one finds research analyses in which the variable(s) with excessive amounts of missing data is (are) simply dropped from the regression equations. For instance, consider the situation of a dataset with, say, 20% of the respondents not responding to a question asking about their personal income. If the researcher were to retain the income variable in the equation and use listwise deletion as the method for handling the missing data, then the analysis would be conducted with 20% fewer cases. An alternative would be to drop income entirely from the analysis and hence be able to retain those 20% of the respondents who failed to report information about their incomes. Like the proxy method just reviewed, this method is not usually discussed in the missing data literature. But it should be avoided without question because of the obvious problem of model misspecification.

The above are five "traditional" methods used for handling missing data. We will use each of them in our analyses of the adolescent fertility of females and males. With the exception of listwise deletion when the data are MCAR, all the others are problematic. For one thing, they will often produce biased estimates and inefficient standard errors. And if listwise deletion is used with MAR data, the estimates will be biased and the standard errors inefficient.[1]

[1]There are other "traditional" methods that researchers have used for handling missing data. Among them are dummy variable adjustment and hot and cold deck imputation. Although we will not use any of these methods in the analyses we undertake in this chapter, we mention each of them here, as follows.

Dummy variable adjustment is an approach widely used in the social sciences; it is also known as the missing indicator method. According to Treiman (2009: 184), "for each independent variable with substantial missing data, the mean (or some other constant) is substituted, and a dummy variable, scored 1 if a value has been substituted and scored 0 if otherwise, is added to the regression equation." Some prefer this method because it is also a test of the MCAR assumption. "If any of the dummy variables has a (significant) nonzero coefficient, the data are not MCAR" (Treiman, 2009: 184). Although some have argued that this approach corrects the missing data for nonrandomness, it has been has shown that it produces biased estimates (Treiman, 2009). And Acock has added that "it gives a false sense of statistical power" (Acock 2005:101–7). Also, if this method is applied to multiple independent variables, one may well have problems with multicollinearity if many respondents fail to provide data on two or more of the same variables (Acock 2005). In sum, this method might seem appealing since it uses all the cases, but it has been shown to produce biased estimates irrespective of whether or not the data are MCAR, MAR or MNAR (Acock 2005; Allison 2002).

Hotdeck imputation is a method used by the U.S. Census Bureau to construct complete data public use samples. According to Treiman (2009: 185) the "sample is divided into strata… Then each missing value within a stratum is replaced with a value randomly drawn (with replacement) from the observed cases within the stratum. As a result, within each stratum the distribution of values for the imputed cases is (within the limits of sampling error) identical to the distribution of values for the observed cases. When the imputation model is correctly specified (that is, when all variables correlated with the missingness of values on a given variable are used to impute the missing values), this method produces unbiased coefficients but biased standard errors. It also tends to perform poorly when a substantial fraction of cases have at least one missing value …"

Cold deck imputation follows the same approach as hotdeck imputation, but it replaces the missing values with those from another data set rather than from the same data set. The hotdeck and cold deck methods may seem to be appealing because they use all the cases, but they have been shown to produce biased estimates irrespective of the reason why the data are missing.

4.3.6 Multiple Imputation (MI) – Three Versions

In the analyses we report in this chapter we will use three different versions of multiple imputation, a method first introduced by Donald Rubin in 1987. Recently has it become a popular method owing to its availability in many statistical packages. For instance, the Stata statistical software package did not include a multiple imputation routine until its release of version 11 in 2008. MI is a more complex and sophisticated method than the ones reviewed above. And there are several variations of MI.

Many hold that MI is the preferred method for handle missing data because "when used correctly, it produces estimates that are consistent, asymptotically efficient and asymptotically normal when the data are MAR" (Allison 2002: 27). Some hold that MI is the current gold-standard approach for dealing with missing data (Treiman 2009: 186).

Multiple imputation is not concerned with recovering the missing data like the traditional methods mentioned above. Instead, it is concerned with estimating the population variances so as to produce generalizable estimates (Acock 2005; Allison 2002; Enders 2010; Rubin 1987). Unique about this method is that it does not treat the data as if "they were real" (Allison 2002). Instead, MI estimates the values by taking into account the uncertainty of the missing values component. MI recognizes that even if the missing values are imputed, there is still uncertainty in those values, so it adjusts the variances to take this into account.

MI has three steps: (1) imputation, (2) analysis, and (3) the combination of the datasets. The imputation stage creates several data sets; the analysis stage runs the desired analysis in each of the data sets; and the combination stage combines the results from the imputations using rules developed by its creator Donald Rubin. Auxiliary variables may be used that are statistically related to the variables with missing values. They are thought to enhance the effectiveness of the imputation stage in the MI process. The auxiliary variables are not used in the regression equation per se, but are used to provide more information about the variances of the independent variables with the missing data. For this reason, some argue that a preferred MI equation is one that uses auxiliary variables (Allison 2002; Treiman 2009). We too subscribe to this assessment.

In addition, the imputation stage needs to have the same structure and variables of the analysis. In other words, it needs to include all the variables in the model. MI calculates the variances within and between the datasets and uses these to adjust the parameter estimates and to produce more accurate estimates than if the data were treated as if they were "real" (Acock 2005; Allison 2002).

Multiple imputation is especially attractive because it can be used with most statistical models. The two main MI iterative methods for handling missing data are the fully conditional specification (FCS) method, and the Markov chain Monte Carlo (MCMC) method.

The fully conditional specification (FCS) method is sometimes known as imputation by chain equation (ICE); it imputes continuous and categorical variables without assuming a multivariate normal distribution. It is sometimes criticized because it is said to lack theoretical soundness. However, simulation studies have shown that it works reasonably well, and the results are comparable to the Markov chain Monte Carlo method (Lee and Carlin 2010).

The Markov chain Monte Carlo (MCMC) method is an iterative procedure that assumes a multivariate normal distribution of all the variables in the model; hence, it works best when imputing continuous variables (Schafer 1997). However, it has been shown that this method can also be used to impute categorical variables (Lee and Carlin 2010).

Nonetheless, multiple imputation does have some problems. For instance, there are no set standards with regard to the number of imputations that should be used, the maximum or minimum amount of data that should be imputed, and how many, if any, auxiliary variables should be used. This lack of specific guidelines may be problematic because different decisions by researchers regarding the above issues could well change the results.

Following the above discussion, we will use three MI methods in our analysis of adolescent fertility, as follows: 6. MI using the fully conditional specification (FCS) method; 7. MI using the Markov chain Monte Carlo (MCMC) method with auxiliary variables; and 8. MI using the Markov chain Monte Carlo (MCMC) method but only imputing the variables with the most missing data, namely education and income.

We will thus estimate eight models of adolescent fertility, handling missing data separately using each of the above methods. We will show that the regression results do indeed vary, and significantly so, depending on which method one uses to handle the missing data.

4.4 Data and Method

The data we use in this chapter are taken from the National Longitudinal Study of Adolescent Health (Add Health) (Harris 2008). This dataset is a nationally representative stratified sample of adolescents in the 7th through the 12th grades who were followed across four waves between 1994 and 2008. The sample was collected from 80 high schools and 52 middle schools and junior high schools across the United States, including Hawaii and Alaska. The first wave of data was collected in 1994–1995, the second in 1996, the third in 2001–2002, and the fourth in 2007–2008; a fifth wave follow-up began in 2016 and will continue through 2018. Data on the parents of the school children were collected in the first wave. In our analyses in this chapter we use data from wave I and wave III for the female and male students and their parents.

We use logistic regression to estimate the log odds of females or males having had a live birth when they were adolescents, i.e., when they were between the ages of 15–19. Our dataset thus includes only participants who were 20 years old or older at the time the wave III data were collected. We constructed the dependent variable, whether the respondent had a live birth when she or he was an adolescent, using several questions from the Add Health Survey. The survey first asked the females and males to assemble a table of pregnancies in which they were involved. For each pregnancy they were asked to "Please indicate the outcome of this pregnancy by selecting the appropriate response: (1) miscarriage, (2) abortion, (3) single stillbirth, (4) live birth, (5) pregnancy not yet ended, (6) multiple, no live birth, (7) multiple, involving both a live birth and another outcome." Then they were asked for information on the month and year of each pregnancy. We calculated their age when each pregnancy ended to determine if they were teenagers when the birth occurred. Subjects who responded that one or more of the pregnancies resulted in a live birth, or in a multiple involving both a live birth and another outcome, prior to their reaching their 20th birthday, were designated by us as having at least one adolescent birth and were scored 1 on the dummy variable of having a live birth while an adolescent; subjects not having an adolescent birth were scored 0.

We selected six theoretically relevant independent variables to predict the log odds of having a teen birth, as follows: (1) the adolescent's race/ethnicity; we measured one's race/ethnicity by first separating Latinos from non-Latinos; the Latinos were divided into Latinos of Mexican Origin and Latinos of other origins (referred to as other Latinos); the non-Latinos were then separated into whites, African Americans and other non-Latinos; in our regression equations we use a series of dummy variables for race/ethnicity (non-Latino African American, Non-Latino White, other Non-Latino, Mexican Origin, and other Latino; non-Latino white was used as the reference); (2) the adolescent's religion was measured with six dummy variables (no religion, Protestant, Evangelical Protestant, Black Protestant, other religion, Jewish, and Catholic; the Catholic dummy was used as the reference group); (3) household income as reported by the parent in wave I (measured in thousands) with $100,000 as the ceiling; (4) parental education as reported by the parent in wave I and measured as the number of years of school completed; (5) the importance of religion to the adolescent ("How important is religion to you?"), ranging from a value of 1 if the young man or woman reported no religious affiliation or responded "not important at all" to a value of 4 if he or she reported "very important"; and (6) the respondent's perceived likelihood to attend college, with 1 as the lowest category and 5 as the highest. All these independent variables have been previously shown to be influential in models predicting whether or not an adolescent had a live birth (cf., Bean and Swicegood 1985; Klepinger et al. 1995).

4.5 Results

We have data for 6726 females and 6143 males. In Table 4.1 we present descriptive data for the females on the dependent variable and the six independent variables.

We show in the first data column of the table the number of women for whom we have data for that variable. The maximum number of female cases is 6726. In column 2 of the table we show for these female subjects the percentage of the cases

Table 4.1 Descriptive Data: 6726 Females, The National Longitudinal Study of Adolescent Health, Waves 1 and 3

Variable	Cases without missing data	Percent missing	Mean	SD
Dependent variable teen birth	6710	0.24	0.14	0.35
Six independent variables				
1. Race/ethnicity	6719	0.10		
White	3568		0.67	0.47
African American	1510		0.17	0.37
Mexican	539		0.06	0.24
Other Latina	538		0.05	0.23
Other	564		0.05	0.21
2. Religion	6620	1.60		
Catholic	1757		0.24	0.43
None	744		0.12	0.32
Protestant	1447		0.22	0.42
Evangelical	1056		0.20	0.40
Black Protestant	884		0.11	0.31
Other	682		0.11	0.31
Jewish	50		0.01	0.09
3. Household income (in thousands)	4983	26.00	$42.7	$27.0
4. Parental education (in years)	5708	15.14	13.27	2.45
5. Religious importance	6717	0.13	3.12	0.93
6. Likelihood of college	6681	0.67	4.25	1.13

with data missing for each respective variable. Of the seven variables used in our logit regression equations (the dependent variable and six independent variables), only three have missing data percentages of more than 1%: household income, 26.0%; parental education, 15.1%; and religion 1.6%.

In Table 4.2 we present the descriptive data for the 6143 males. Similarly, for the male subjects, only three have missing data percentages of more than 1%: household income, 24.1%; parental education, 14.5%; and religion 1.8%.

With around one quarter of the females and the males both having missing data on income, this means we would lose at least this percentage of respondents from the analysis were we to rely on listwise deletion as the method for handling missing data.

Of the females in the analysis (Table 4.1), we show in the third data column that 14% report having had a teen birth. Almost 70% are white, and their mean household income is just under $43 thousand. Religion is fairly to very important for most of the female subjects, and most believe it is very likely they will attend college.

The data for the males (Table 4.2) are remarkably similar to those for the females, except for the percentage reporting having had an adolescent birth. Only 5% of the males report having had an adolescent birth, compared to 14% of the females.

Table 4.2 Descriptive Data: 6143 Males, The National Longitudinal Study of Adolescent Health, Waves 1 and 3

Variable	Cases without missing data	Percent missing	Mean	SD
Dependent variable teen birth	6122	0.34	0.05	0.22
Six independent variables				
1. Race/ethnicity	6140	0.05		
White	3287		0.67	0.47
African American	1182		0.16	0.36
Mexican	542		0.07	0.25
Other Latina	512		0.05	0.22
Other	617		0.06	0.23
2. Religion	6035	1.76		
Catholic	1600		0.25	0.43
None	794		0.14	0.34
Protestant	1335		0.22	0.41
Evangelical	898		0.18	0.38
Black Protestant	652		0.10	0.29
Other	717		0.12	0.32
Jewish	39		0.01	0.09
3. Household income (in thousands of dollars)	4660	24.14	$42.2	$26.0
4. Parental education (in years)	5250	14.54	13.33	2.41
5. Religious importance	6137	0.10	2.99	0.95
6. Likelihood of college	6101	0.68	3.98	1.24

The fact that the percentage of males reporting an adolescent birth is quite a bit lower than that of the females is likely due to the males not having as direct a knowledge of a pregnancy as the females. This finding of differential male and female fertility rates is consistent with empirical research on the topic (Greene and Biddlecom 2000; Zhang et al. 2014).

More than two-thirds (67%) of the males are white, and their average household income is just over $42 thousand. Religion is important to fairly important for them, and most state it is very likely they will attend college (see Table 4.2).

The fertility data for the females and males were analyzed using the eight different approaches discussed above for handling missing data, namely, (1) listwise deletion, (2) overall mean substitution, (3) mean substitution where the mean values were substituted on the basis of the race/ethnicity of the respondents, (4) the proxy method where mother's education was used as a proxy for income, (5) dropping the two variables with excessive amounts of missing data, namely, parental education and household income, (6) multiple imputation in which all the variables with missing data were imputed using the fully conditional specification iterative method, (7) multiple imputation using the Markov chain Monte Carlo iterative method with three auxiliary variables,[2] and (8) multiple imputation using the Markov chain Monte Carlo iterative method to impute only the two variables with the most missing data, namely household income and parental education. In each of the three MI applications, a total of 100 imputations were undertaken. For the females, the 16 cases (only 0.2% of all the female respondents) that were missing on the adolescent fertility dependent variable were imputed in the imputation stage, but they were dropped from the analysis (von Hippel 2007). We followed the same strategy for the 21 males (only 0.3% of all the male respondents) with missing data on the fertility question.

Since the Add Health Survey is based on multistage probability sampling, one should not make inferences with these data to the larger population of U.S. women and men from which the sample was drawn without first taking into account the sampling design. Otherwise, the data will be treated by the statistical software as based on a simple random sample. Thus we used the "svy" suite of statistical sample adjustment methods available in the Stata 14 statistical package (StataCorp 2016) that introduce survey adjustment estimators.

In Table 4.3 we present the results from the eight logistic regressions modelling the log likelihood of a female having a live birth while a teenager. Each regression equation handles missing data in a different way, as discussed earlier. Our preferred method for handling missing data is "multiple imputation using auxiliary variables," shown as model 7 (M7) in the table. In Table 4.4 we present the regression results from these eight logistic regressions for males.

The values in the first line for each variable in Tables 4.3 and 4.4 are the logistic regression coefficients predicting the log odds of a female (Table 4.3) or of a male (Table 4.4) having an adolescent birth; if the coefficient is statistically significant, it is asterisked (see legend at the bottom of the tables). Immediately below the logit coefficient is its semi-standardized coefficient; this is the logit coefficient that has been standardized in terms of the variance of the independent variable, i.e., the logit coefficient has been multiplied by its standard deviation (Long and Freese 2014: 180–181). Alongside each of the statistically significant semi-standardized coefficients, in parentheses, is shown the ranking in that equation of its relative effect on the outcome of having a teen birth.

The regression results in Tables 4.3 and 4.4 indicate that for some independent variables, whether they are or are not statistically significant, does not depend at all on which missing data method is used. For the female respondents (Table 4.3), three of the religion variables (Evangelical, Black Protestant and Jewish) are statistically significant in predicting the likelihood of the woman having an adolescent birth in all eight equations, as are the household income variable and the likelihood to attend college variable. With respect to the male subjects (Table 4.4), only the parental

[2] We used three auxiliary variables. Two questions were asked of the parents, namely, "How important is religion to you?" and "Do you have enough money to pay your bills." And one question was asked of the students, namely, "How much do you want to go to college?" All three auxiliary questions were answered on a 1–4 or a 1–5 point scale from low to high.

Table 4.3 Eight logistic regression models predicting having a teen birth, according to the method used to handle missing data: females surveyed in The National Longitudinal Study of Adolescent Health, Waves 1 and 3

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
1. Race/ethnicity								
White	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
African American	.376†	.316†	.340	.475*	.474**	.181	.198	.272
	.133(6)	.117(7)	.103	.172(6)	.175(5)	.064	.070	.096
Mexican-origin	.496	.469†	.416	.507	.673**	.333	.336	.377
	.111	.112(8)	.100	.118	.161(6)	.075	.076	.085
Other Latina	.325	.320	.284	.459*	.507*	.258	.260	.264
	.075	.072	.064	.106(9)	.114(7)	.059	.060	.061
Other	−.490	−.357	−.351	.216	−.272	−.391	−.386	−.385
	−.098	−.077	−.075	.044	−.058	−.078	−.077	−.077
2. Religion								
Catholic	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
None	.337	.217	.217	.407†	.277	.188	.222	.197
	.109	.071	.070	.131(8)	.090	.061	.072	.064
Protestant	.304†	.234	.232	.357*	.222	.254	.256	.240
	.129(7)	.097	.097	.150(7)	.092	.108	.108	.102
Evangelical	.475*	.546***	.551***	.675***	.663***	.518***	.519***	.516***
	.187(5)	.217(5)	.219(6)	.268(2)	.264(4)	.204(5)	.205(5)	.204(5)
Black Protestant	.794***	.853***	.846***	.974***	.897***	.885***	.843***	.810***
	.230(4)	.262(4)	.260(4)	.293(3)	.276(3)	.265(3)	.244(2)	.235(3)
Other	.127	.198	.199	.344†	.250	.208	.209	.189
	.039	.061	.062	.106(10)	.078	.065	.065	.059
Jewish	−2.558***	−3.219***	−3.217***	−3.123***	−3.474***	−3.104***	−2.537***	−3.103***
	−.233(3)	−.304(1)	−.304(1)	−.308(1)	−.328(1)	−.282(2)	−.230(4)	−.282(2)

3. Hh income	−.014***	−.013***	−.013***			−.013***	−.013***	−.013***
	−.392(1)	−.301(2)	−.300(2)			−.357(1)	−.360(1)	−.357(1)
4. Par-Educ	−.023	−.031	−.027	−.080***		−.034	−.033	−.034
	−.056	−.070	−.061	−.195(5)		−.083	−.082	−.084
5. Relig-imp	−.094	−.133†	−.134†	−.108	−.133*	−.109	−.095	−.139†
	−.083	−.121(6)	−.122(5)	−.096	−.121(8)	−.096	−.084	−.144(6)
6. College Lik	−.220***	−.238***	−.239***	−.236***	−.285***	−.213***	−.211***	−.212***
	−.241(2)	−.266(3)	−.266(3)	−.259(4)	−.319(2)	−.233(4)	−.231(3)	−.232(4)
Intercept	−.284	−.044	−.003	−.106	−.759	−.084	−.138	−.022
F	12.05	13.94	13.72	11.66	13.58	13.80	11.56	15.21
N	4847	6583	6583	5586	6583	6710	6710	6583

†$p < 0.05$ (one tail);*$p < 0.05$ (two tail); **$p < 0.01$ (two tail);***$p < .001$ (two tail)
Model 1: Listwise deletion
Model 2: Full Mean substitution
Model 3: Mean substitution by race and ethnicity
Model 4: Education as a proxy for income
Model 5: Income and education variables dropped
Model 6: Multiple imputation using the fully conditional specification method
Model 7: Multiple imputation using Markov chain Monte Carlo method with auxiliary variables
Model 8: Multiple imputation using Markov chain Monte Carlo method (imputed only education and income)

Table 4.4 Eight logistic regression models predicting having a teen birth, according to the method used to handle missing data: males surveyed in The National Longitudinal Study of Adolescent Health, Waves 1 and 3

	Model 1	Model 2	Model 3	Model 4	Model 5	Model 6	Model 7	Model 8
1. Race/ethnicity								
White	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
African American	.303	.363	.339	.390	.462	.359	.377	.313
	.106	.130	.122	.137	.166	.125	131	.109
Mexican-origin	.587	.498	.451	.510	.714*	.348	.342	.392
	.137	.125	.113	.122	.179(2)	.081	.080	.092
Other Latino	.011	.281	.250	.269	.472	.135	.142	.209
	.003	.063	.056	.060	.106	.030	.031	.046
Other	.645	.563†	.575†	.737†	.637†	.485	.490	.536
	.138	.132(4)	.135(4)	.159(3)	.149(3)	.104	.105	.115
2. Religion								
Catholic	Ref	Ref	Ref	Ref	Ref	Ref	Ref	Ref
None	.573	.340	.345	.503	.397	.337	.425	.359
	.199	.117	.119	.173	.137	.117	.148	.125
Protestant	.066	−.239	−.236	−.083	−.236	−.236	−.193	−.213
	.028	−.099	−.097	−.035	−.097	−.099	−.081	−.090
Evangelical	.353	.098	.108	.215	.175	.103	.112	.097
	.136	.038	.042	.083	.068	.040	.043	.037
Black Protestant	.362	.049	.058	.212	.107	−.091	−.123	.067
	.104	.014	.017	.061	.031	−.026	−.035	.019
Other	−.027	−.040	−.036	−.131	−.045	−.066	−.060	−.023
	−.008	−.013	−.012	−.042	−.015	−.020	−.019	−.007

Jewish							−2.972**	
							−.238(2)	
3. Hh Income	−.009	−.009†	−.009†			−.011*	−.011*	−.009*
	−.227	−.203(2)	−.205(2)			−.275(1)	−.274(1)	−.234(1)
4. Par-Educ	−.114**	−.073†	−.065†	−.114***		−.072†	−.075†	−.081*
	−.269(1)	−.164(3)	−.148(3)	−.275(1)		−.170(3)	−.178(4)	−.191(3)
5. Relig-imp	.025	.049	.047	.013	.051	.050	.070	.048
	.022	.046	.044	.012	.047	.045	.063	.044
6. College Lik	−.116	−.190**	−.191**	−.150*	−.246***	−.162*	−.160*	−.167*
	−.143	−.234(1)	−.235(1)	−.184(2)	−.304(1)	−.199(2)	−.196(3)	−.205(2)
Intercept	−1.156	−1.239	−1.321	−1.264	−2.403	−1.268	−1.325	−1.224
F	5.29	4.23	4.08	4.71	2.54	4.11	3.81	4.33
N	4504	5954	5954	5094	5954	6083	6122	5954

†$p < 0.05$ (one tail);*$p < 0.05$ (two tail); **$p < 0.01$ (two tail);***$p < .001$ (two tail)
Model 1: Listwise deletion
Model 2: Full Mean substitution
Model 3: Mean substitution by race and ethnicity
Model 4: Education as a proxy for income
Model 5: Income and education variables dropped
Model 6: Multiple imputation using the fully conditional specification method
Model 7: Multiple imputation using Markov chain Monte Carlo method with auxiliary variables
Model 8: Multiple imputation using Markov chain Monte Carlo method (imputed only education and income)

education variable is statistically significant in all eight equations predicting the log odds of the male reporting an adolescent birth.

Some of the variables are not statistically significant in any of the eight regression equations. For the female subjects (Table 4.3), the "other" race/ethnicity variable and the "other" religion variable are never statistically significant. Among the male respondents (Table 4.4), eight of the variables are not statistically significant in any of the eight equations, namely, African American and the Other Latino race/ethnicity, five of the six religion variables, and the religion importance variable.

But the statistical significance of all the other variables depends on which missing data method is used. In all three multiple imputation methods, among the females (Table 4.3), being an African American has no significant effect on the likelihood of having an adolescent birth; but this variable does have an effect on adolescent fertility in four of the other equations, including the equation using listwise deletion (Model 1) the default method for handling missing data in most statistical packages. Being a Mexican-origin woman or being an "other" Latina are not significant predictors in any of the multiple imputation methods but are significant when mean substitution and dropping the variables are used. The importance of religion has a similar pattern. Parental education is only significant when education is used as a proxy for income.

For the male respondents (Table 4.4), being a member of an "other" race/ethnicity does not have a significant effect on the log odds of having an adolescent birth in four of the equations, but does have a significant effect in the other four equations. Household income has a statistically significant effect on the likelihood of males having an adolescent birth in each of the multiple imputation models, but it does not have a statistically significant effect in Model 1, the listwise deletion model. The variable designating a person being a Jew was automatically dropped, from all the models except the preferred model with auxiliary variables, because it was a perfect prediction of failure.

It is worth noting that, ideally, multiple imputation is best implemented with auxiliary variables (Model 7); however, since auxiliary variables are not always available in one's dataset, it is acceptable to use MI without them. It turns out that in the analyses we conducted in this chapter, our regression results are fairly, but not entirely, consistent across the three MI methods we used.

Clearly, for many of the variables, for both females and males, the method used to handle missing data has an important influence on whether or not the independent variables have significant effects in models of adolescent fertility.

Another way to evaluate the logit regression results in Tables 4.3 and 4.4 is via the rankings of the statistically significant semi-standardized coefficients. As noted above, these are the logit coefficients that have been standardized in terms of the variances of their independent variables, that is, the logit coefficients have been multiplied by their standard deviations (Long and Freese 2014: 180–181). Although there is a problem in the interpretation of the meaning of a semi-standardized coefficient when the independent variable is a dummy variable (there are many dummy variables in the equations) (Poston 2002: 342), their values nonetheless indicate the relative effects of each of the independent variables on the log odds of the woman or the man having a teen birth. In the second row for each variable in each of the eight columns of Tables 4.3 and 4.4 we show the rankings of the magnitude of the semi-standardized coefficient in predicting the outcome.

Among the female subjects (Table 4.3), in four of the equations, household income is ranked first, that is, in four equations it has the greatest relative effect on the outcome of having an adolescent birth; but in two of the equations, those using mean substitution (M2 and M3), it has the second greatest relative effect.

The degree to which being an Evangelical is influential in predicting the outcome varies tremendously according to the method used to handle missing data. If mean substitution with race (M3) is used, this variable has the 6th most influential effect, but if the method using education as a proxy (M4) is employed, it has the 2nd most influential effect on the outcome. The importance of the effect on the outcome of a woman being a Jew varies from the 1st most important effect in several of the equations (M1, M2, M3 and M4) to the 4th most important effect in the equation (M7) that we have designated as the preferred model.

Among the male respondents (Table 4.4), the rankings of the significant predictors do not vary as much as they do for the females because there are fewer statistically significant effects in the male equations. Nevertheless, among the males, the perceived likelihood of college varies from being the most important predictor of having a teen birth in three of the equations (M2, M3 and M5), to being the 2nd most important predictor in three more equations (M4, M6 and M8), to being the 3rd most influential predictor in M7 (the preferred equation), to not having a statistically significant effect in M1, listwise deletion, the default method in most statistical packages.

Clearly the importance of the relative effects of the independent variables on the likelihood of a woman or a man having an adolescent birth vary considerably depending on how missing data are handled in the regression equation. We turn now to a discussion of our results.

4.6 Discussion

In this chapter we discussed the importance of missing data and many of the different methods that have been developed to address the problem. We used data on over six thousand women and over six thousand men from the National Longitudinal Study of Adolescent Health to predict the likelihood of the woman or the man having had a birth when she or he was a teenager. We handled the problem of missing data using eight different approaches. Depending on the method used, our results indicate that many of the independent variables in our models vary in whether they are, or are not, statistically significant in predicting the log odds of a person having a teen birth; and many of the independent variables that are statistically significant vary in the ranking of the magnitude of their relative effects on the outcome variable. In summary, our results show that the levels of significance of the effects, the size of the effects, and their relative importance vary considerably depending on the method used to handle the missing data.

Understanding differences between minority group members and whites, and the differential influences of minority membership on an outcome such as adolescent fertility, is a very important sociological question with considerable political and social implications. But we showed in our chapter that the issue of missing data and how a researcher chooses to handle the missing data can have an impact on how we understand this social issue. To illustrate, we showed that if a researcher used listwise deletion, mean substitution, a proxy, or dropped the variables to handle the problem of missing data in equations modelling whether or not a woman had an adolescent birth, the results would lead the researcher to conclude that after controlling for all the other variables in the model, African American women were more likely than White women to have had an adolescent birth. But if the researcher used multiple imputation with or without auxiliary variables as the method to handle the missing data, the results would indicate no statistically significant difference between African American women compared to White women regarding the log odds of having had a teen birth. In other words, listwise deletion, the default method in most statistical packages, and multiple imputation with auxiliary variables, the so-called "gold standard," give exactly opposite results regarding the log odds of an African American woman compared to a White woman having an adolescent birth.

After controlling for other relevant variables, are African American women more likely than white women to have had an adolescent birth? If the researcher uses listwise deletion or mean substitution to handle missing data, the answer is yes. If the researcher uses multiple imputation with auxiliary variables to handle the problem of missing data, the answer is no.

Another interesting research question concerns the extent to which the socioeconomic characteristics of the respondents influence their likelihood of having teen births. We consider here the case of the males. Our results show that when we use the so-called "gold standard" method (M7) for handling missing data, the respondent's household income and his perceived likelihood of attending college have negative effects on his likelihood of having a teen birth. But if we use listwise deletion (M1) the default method for handling missing data, these two variables do not have statistically significant effects on the log odd of having a teen birth. Using different methods in this case results in very different conclusions with regard to the effect of socioeconomic status on fertility.

Some researchers have handled missing data using proxy variables. The use of proxies also has important implications for scientific research. We showed that among our female respondents when parental education is used as a proxy for household income, it has a statistically significant effect in modelling teen fertility, but when one uses household income in the equation the effect of parental education disappears. In the male equations, the parental education has by far the most influential effect on teen fertility when it is used as a proxy for household income; but this variable is much less influential in the other equations when it is used as a predictor along with household income.

These findings are very important for at least two reasons. First from a social policy perspective, the mechanisms and policies that can have an impact on income versus those that can have an effect on education are often very different. Thus, knowing that the two variables have different effects predicting the likelihood of an adolescent birth depending on how one handles the problem of missing data is critical for conducting sociological research. Second, from a theoretical perspective, the use of proxies can have important implications because they might be measuring completely different constructs. For example, the health literature has shown that the effect of education on health is not the same as the effect of income on health (Mirowsky and Ross 2003). Education taps human capital while income is usually restricted to financial resources (Sen 1999). Therefore the effect of education versus that of income can potentially have very different effects on other models related to health outcomes.

The analyses we conducted in this chapter have shown clearly and conclusively that missing data is indeed a critical component of scientific research, and that different techniques will often lead to different statistical and theoretical conclusions. The next logical question is, how do we handle missing data when there are potential problems, even with the gold standard of multiple imputation.

One of the best and most interesting responses to this question is by Paul Allison: "The only good solution to missing data is not to have any" (Allison 2002: 2). But since this is an unrealistic option, we propose that it is reasonable to ask researchers who are conducting analyses with missing data to report the results of both listwise deletion and multiple imputation. As we stated earlier, listwise deletion is still controversial, and MI is considered to be the gold standard. In addition, the researcher should try different methods of multiple imputation, i.e., with auxiliary variable and without them, and with several different numbers of imputations (say, 50, 75, and 100), so to determine the level of consistency of the findings. Analyses with strong theories and consistent results across different methods of handling missing data should not be problematic. But when the findings are inconsistent, that is, they vary depending on how the missing data are handled, and also when there is no strong theory, then the results should be rendered as inconclusive.

Finally, an important recommendation of our chapter is that the effect of missing data on scientific research requires more scrutiny. Journal editors should require their authors to report precisely the amount of data that is missing in their variables, as well as to specify and justify the method they used to handle the missing data (Sterne et al. 2009). We specifically recommend that researchers estimate their models with both listwise deletion and with multiple imputation and report if there are any differences that would lead to different theoretical or empirical conclusions. Research conducted with large amounts of missing data should be scrutinized with serious deliberation and forethought, and the findings, if inconsistent across method, should be interpreted with caution.

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Chapter 5
Considering Local Measures of Poverty Using Shift-Share Techniques: A Comparative Analysis

Gregory L. Hamilton and Melody Muldrow

5.1 Introduction

When President Lyndon Johnson enlisted aid from economists, social scientists, and policymakers for his War on Poverty, we still find it difficult four decades later maneuvering through the maze of conceptualizing and measuring poverty (Celllini et al. 2008). Is it time to reevaluate how we measure poverty? Would an alternative technique such as shift share analysis provide a better measure of poverty which could lead to a better understanding of poverty?

One of the benefits in using shift-share analysis is the technique's ability to isolate the changes in poverty by decomposing these changes into three components: state, regional and competitive effect. This competitive effect is the unexplained component of poverty usually associated with the local factors causing poverty for the region by eliminating the exogenous state and regional effects on local poverty.

Removing the state and regional effects gives the researcher the ability to answer the following question: do variables that typically explain poverty have greater explanatory power with regards to the variation in local poverty across counties? This is of particular importance when examining poverty trends in Arkansas.

Ranking fourth in the nation with a poverty rate of 19.6% in 2012, poverty is a serious issue for the state of Arkansas (U.S. Census Bureau, Small Area Income and Poverty Estimates). The state's agriculture-based economy and low education attainment have created impoverished conditions that some state residents continue

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to endure. In fact, Arkansans living in the rural part of the state tend to experience more persistent poverty compared to their urban counterparts.

In this chapter we seek to determine if the employment of shift-share analysis improves our understanding of the causes and characteristics of poverty at the county level in Arkansas. Specifically, we address the following research questions: Can using local poverty measure computed with shift-share technique enhance our understanding of poverty at the local level? Do variables that typically explain poverty have greater explanatory power with regard to the variation in the local poverty measures across counties? Will eliminating the exogenous state and regional effects on local poverty improve our understanding of how local factors impact poverty?

To answer these questions, our research compared the results from estimated regression equations, using the standard poverty measure and the shift-share measure as dependent variables, to determine whether the shift-share measure of poverty improves our understanding about the causes and characteristics of poverty at a county level. We employed shift-share techniques in a panel data model measuring the poverty rate of the 75 Arkansas counties observed over the period 1989–2000 and 2000–2010.

Our chapter is organized as follows: The next section provides the reader with brief background information on shift-share analysis. Section 5.3 discusses the methodology of shift-share analysis and the measure of local poverty. Section 5.4 discusses the methodology and data used in our research. Section 5.5 interprets the empirical findings. Finally, Sect. 5.6 contains concluding comments and possible suggestions for future research.

5.2 Shift-Share Analysis: Background

There are three components identified and measured in shift share models. They are national, industry-mix, and competitive effects (Chen and Xu 2007; Shi and Yang 2008). The national effect is the overall growth or decline that all regions experienced; it compares the region growth or decline with the national growth or decline. The national effect measures the change in a local area compared to the nation.

Due to different sizes and compositions of industries, some regions experience growth rates that differ from the nation. This growth is commonly referred to as the industry-mix effect. The industry-mix effect measures the magnitude of fast and slow growing industries in a region relative to the nation.

The competitive effect, also known as the local-share effect, examines why some industries grow at a faster rate than others. This effect endeavors to measure the "competitiveness" of the county and the industries located in the county. In other words, the competitive effect determines if local industries are gaining or losing ground "in their proportionate share of employment, relative to the area" (Gordon and Darling 1976). According to Houston (1967), since the competitive effect measures regional activity at the end of a time period, it is a residual measurement. This implies that this residual measurement should have a zero mean in repetitive sampling if random effects exist within the region.

Since the shift-share model can measure industrial change over time, in addition to measuring the differential growth patterns on an absolute and relative level, Shi and Yang (2008) deemed the model to be the simplest technique to examine differential growth rates. Matlaba et al. (2012) used a traditional shift share model to deconstruct the changes in Brazil's employment rate. Their specification consisted of the following equations.

$$\Delta E_{ir}^{t} = E_{ir}^{t} - E_{ir}^{t-1} - NE_{ir}^{t} + IM_{ir}^{t} + CE_{ir}^{t} \tag{5.1}$$

$$NE_{ir}^{t} = g_{00}^{t}\, x\, E_{ir}^{t-1} \tag{5.2}$$

$$IM_{ir}^{t} = \left(g_{i0}^{t} - g_{00}^{t}\right) x\, E_{ir}^{t-1} \tag{5.3}$$

$$CE_{ir}^{t} = \left(g_{ir}^{t} - g_{i0}^{t}\right) x\, E_{ir}^{t-1} \tag{5.4}$$

where:

E_{ir}^{t}, E_{ir}^{t-1} the employment for each of the i^{th} industry in the r^{th} region at time t and t-1.
g_{00}^{t} growth rate in nation employment between time t and t-1.
g_{ir}^{t} the employment growth rate in the i^{th} industry between time t and t-1.
$NE_{ir}^{t}, IM_{ir}^{t}, CE_{ir}^{t}$ are the national effects, industry-mix effect, and the competitive effect for the i^{th} industry in the r^{th} region r, respectively.

Aggregating Eqs. (5.1), (5.2), (5.3) and (5.4) for each region and industries yields the growth rate of total employment for the region *r* at t and t- 1 time (Matlaba et al. 2012). Owing to the adaptability and simplicity of the shift-share model, it comes as no surprise that this model is used in many academic disciplines (Chen and Xu 2007). Logically, the shift-share model provides a practical and systematic method to separate the local factors associated with poverty for a region.

5.3 Local Poverty Measures and Shift-Share Analysis

The U.S. Census Bureau defines poverty as the number of people with family incomes below the poverty income threshold adjusted for family size composition (http://www.census.gov). The poverty rate (per thousand) is determined by taking the total number of people living in the county in poverty and dividing this figure by the county total population.

Shift-share analysis is a descriptive technique used to identify components of regional growth and decline. Substituting Eqs. (5.2), (5.3) and (5.4) (see above) into Eq. (5.1) to obtain the local poverty measure associated with the state, region, and local poverty effects results in the following equation:

$$\Delta POV_i^{t+n} = \left(POV_i^{t+n} - POV_i^t\right) - G^{t+n}\, x\, POV_i^t + \left(G_r^{t+n} - G^{t+n}\right) x\, POV_i^t + \left(g_i^{t+n} - G_r^{t+n}\right) x\, POV_i^t. \tag{5.5}$$

where:

POV_i^{t+n} represent the number of people in poverty in county i^{th} at t + n time.
POV_i^t represent the number of people in poverty county i^{th} at t time.
G^{t+n} represent the state's growth rate of the number of people in poverty between t and t + 1 time.
G_r^{t+n} represent the growth rate of the number of people in poverty in the r^{th} region between t and t + n time.
g_i^{t+n} represent the growth rate of the number of people in poverty in the r^{th} region between t and t + n time.

5.4 Estimation Methodology & Data

5.4.1 One-Way Fixed Effects Model

A fixed effect regression model was used to account for several Arkansas counties having persistent poverty (Partridge and Rickman 2007). Due to the nature of the data set used in our research, a panel data model was employed to analyze poverty rates for counties in Arkansas. This model incorporates both time series and cross sectional observations. A brief description of the model follows.

As noted previously, several Arkansas counties have persistent poverty. We hence used a panel data model to analyze the poverty measures for the counties. To account for the regional fixed effect associated with persistent poverty, a regional variable based on the Arkansas Economic Development Administration Planning and Development region was incorporated in the regression analysis (Partridge and Rickman 2007).

Equation 5.6 below gives the form of the one-way fixed effects model:

$$Y_{it} = \alpha_i + \beta_1 X1_{it} + \beta_2 X2_{it} + \ldots + \beta_K XK_{it} + \varepsilon_{it}. \tag{5.6}$$

where "i" represents cross-section units, in this case, the 75 counties in Arkansas.

The time-series "t" represents the time-series unit in this analysis. Y_{it} contains observations on the dependent variable. The dependent variables are the county poverty rate per thousand and the local poverty rate. The $X1_{it} - XK_{it}$ variables contain observations on the independent variables of the model. The β parameters measure the effects of these exogenous variables on Y. The error term ε_{it} captures the stochastic disturbances of the model.

The "α_i" parameters in Eq. (5.6) measure county-specific "individual effects" that represent different autonomous levels of Y for each county. In this model we assume that each individual county will have identical marginal effects for the explanatory variables. However, we believe that each county will be characterized by unique "unobserved heterogeneity." Unobserved heterogeneity is an exogenous factor, which cannot be measured explicitly, that causes each cross-section unit to differ from each other (Kennedy 1998). In other words, each county has a unique "trait" that sets it apart from the other counties, and this trait does not vary over time. For instance, Phillips County's goals toward economic development may differ from those of Crittenden County. These traits are called "county-specific" effects. In the fixed-effects model, we assume that such effects can be captured by allowing for a different intercept for each county; that is, the α_i terms (Kennedy 1998). Since our research uses a ten-year time period to analyze poverty, the rates will not incur major changes during a ten-year period; thus, it would be inappropriate to use a two-way fixed effects model.

5.4.2 Data

Table 5.1 provides descriptive statistics and definitions of the explanatory variables. The expected signs of the estimated coefficients indicate the type of causal relationship expected between the explanatory variable and the measure of poverty.

MHHY is the average income (wages) earned by the household. Counties with a high median household income can be assumed to experience a strong economy (Levernier et al. 2000). Therefore, the expected sign on this variable is negative, indicating, that as household income increases, the poverty rate will decrease, all else remaining constant. Our research also examines the average household income AHHY effect on poverty in Arkansas. The expected sign on this variable should also be negative, implying that as average household income increase the poverty rate will decrease, all else remain constant.

EDHS is the number of people who obtained a high school diploma. Rupasingha and Goetz (2003) showed that increasing an individual's human capital is one way in which they may move out of poverty. With the technological advances in the labor market, increasing one's educational attainment is a necessary requirement for working in high-tech industries. Hence, high school completion is expected the be negatively associated with poverty. The negative sign implies that as the county high school completion rates increase, poverty rates will decrease.

EDLHS is the number of people who did not obtained a high school diploma. It is expected that as the proportion of a county's population with less than high school completion increases, its poverty rate will increase as well, ceteris paribus.

EPOWTEMP is the number of county workers working full and part time earning income by place of work. The effect of EPOWTEMP on a county's poverty rate should be negative.

AVEMEDHHY is the ratio of average family income to median family income. This variable measures the extent of income inequality in a county. The expected

Table 5.1 Explanatory variables & descriptive statistics

Variable	Description	Obs	Mean	Std. Dev.	Min	Max	Expected sign for estimated coefficient
MHHY	Median household income	150	$32,020	5948	$20,510	$51,589	Negative
EPOW	Earnings by place of work	150	$727,228	1,765,569	$38,986	$16,100,000	Negative
TEMP	Annual number of full and part time workers	150	20,259	39,213	2026	308,839	Negative
EPOWTEMP	Earnings by place of work per worker	150	$30,190	7377	$13,109	$52,117	Negative
AHHY	Average household income	150	$42,343	6895	$28,519	$65,345	Negative
AVEMEDHHY	Ratio of average to median household income	150	1.34	0.20	0.81	2.14	(Positive?)
BWHPOP	Ratio lack to white populations per 1000	150	260	358	0	1739	Positive
EDLHSHSRATE	Educational attainment: High school or less to population 25 years or older per 1000	150	526	55	336	637	Positive
FEMHEHRATE	Ratio of female head of household to per 1000	150	150	187	11	1861	Positive
POVERTY	Number of people living in poverty	150	6164	7792	804	64,502	Dependent variable

(continued)

Table 5.1 (continued)

Variable	Description	Obs	Mean	Std. Dev.	Min	Max	Expected sign for estimated coefficient
POVRATE	Ratio of people living in poverty to population per 1000	150	185	46	84	355	Dependent variable
LOCPOVRATE	Ratio of local poverty measure to population per 1000	150	−618	1484	−5224	4436	Dependent variable

Data Sources: Bureau of Economic Analysis and U.S. Census Bureau

sign of this estimated coefficient is ambiguous. This relationship depends upon the income range and degree of skewness in the distribution of income.

BWPOP is the percentage of the county population who identifies as African American. We expect that the percent African American will be positively associated with the poverty rate (Levernier et al. 2000; Rupasingha and Goetz 2003).

FEMHEAD is the percentage of county population households headed by a female. There is a positive association between female-headed households and poverty. In fact, "poverty rates are higher for female-headed families" (Rupasingha and Goetz 2003). The female headed-household typically has below-average job skills (Partridge and Rickman 2007).

The explanatory variables and their first differences, denoted by a D, are used as a comparative regression model to assets the validity of the model's ability to provide any additional information regarding the causes of local poverty. Several different specifications were estimated, and the results are reported below in a later section. The analysis was restricted to poverty estimates for 1989, 2000, and 2010 for the 75 counties in Arkansas.

Shift-share measures of poverty gauge the change in poverty between the periods 1989–2000 and 2000–2010. Poverty rates are discrete annual measures while the shift-share measures are first differences. A comparison between these alternative poverty measures contrasts a stock and a flow variable. The data sources for all the variables used here were obtained from the U.S. Bureau of Economic Analysis and U.S. Census Bureau.

5.5 Findings

To recapitulate, our research questions were the following. Does the use of local poverty measures computed with shift-share technique enhance our understanding of poverty at the local level? Do variables that typically explain poverty have greater explanatory power with regards to the variation in the local poverty measures across counties? Will eliminating the exogenous state and regional effects on local poverty improve our understanding of how local factors impact poverty?

Comparing the results from estimated regression equations, using the standard poverty measure and the shift-share measure as dependent variables provides a simple test to determine whether the shift-share measure of poverty improves our understanding of the causes and characteristics of poverty at a county level. The model findings are presented below.

Model 1 uses contemporary explanatory variables to establish the relationship between the standard poverty rate and the explanatory variables using ordinary least square (OLS) and fixed effect (FE) estimators, and comparing the findings with the local shift-share poverty measure estimates using the same explanatory variables.

Table 5.2 provides the estimation results for the fixed-effect model. Observing the goodness of fit statistics for this fixed-effect model, R^2 is 80% which means that the fixed-effect approach provides a good fit. AVEMEDHHY is the only variable that is not statistically insignificant.

Comparing the empirical results from the standard poverty measure with the shift-share analysis of poverty from Model 1, the results indicate that the standard poverty measurement, as in the OLS model, is the superior regression model in explaining variations in poverty. The fixed- effect model and the fixed- effect

Table 5.2 Regression results for model 1

Model 1	OLS estimator	OLS estimator	FE estimator	FE estimator
Explanatory variables	POVRATE	LOCPOVRATE	POVRATE	LOCPOVRATE
MHHY	−0.0045∗∗∗	0.0033∗∗∗	−0.0042∗∗∗	0.0032∗∗∗
EPOWTEMP	−0.0009∗	0.0016∗∗	−0.0009∗∗	0.0005
YEAR	64.1183∗∗∗	−103.7834∗∗∗	62.5719∗∗∗	−100.0389∗∗∗
AVEMEDHHY	−4.0957	−0.9200	−1.7252	3.5985
LFPART	−0.1039∗∗	−0.0213	−0.0981∗∗	−0.0263
BWHPOP	0.0523∗∗∗	−0.0378∗∗∗	0.0521∗∗∗	−0.0726∗∗∗
EDLHSHSRATE	−0.0772∗	−0.0748	−0.0739	−0.3101∗∗∗
FEMHHRATE	0.0269∗	−0.0801∗∗∗	0.0297∗∗	−0.0653∗∗∗
Constant	425.3788∗∗∗	−62.2884	407.3960∗∗∗	100.2238
N	150.0000	150.0000	150.0000	150.0000
F	80.7219	49.7221	62.2070	69.4000
rho			0.0614	0.5634
r2_a	0.8043	0.6692	0.7641	0.7838

FE∗: Significant FE at 5% level

∗ $p < 0.05$; ∗∗ $p < 0.01$; ∗∗∗ $p < 0.001$

Table 5.3 Regression results for model 2

Model 2	OLS estimator	OLS estimator	FE estimator	FE*estimator
Explanatory variables (change in)	DPOVRATE	LOCPOVRATE	DPOVRATE	LOCPOVRATE
DMHHY	−0.0004	−0.0143	−0.0001	−0.0120
DEPOWTEMRATE	0.0009	−0.0680	0.0006	−0.0767
DLFPOPRATE	−0.0733	−0.9368	−0.0549	−0.6561
DBWPOPRATIO	0.1008	−8.3411*	0.0700	−8.4160**
DEDLHSHSRATE	−0.0450	−4.8014	−0.0823	−2.7853
DFEMHHRATE	−0.0032	−0.3855	−0.0160	0.8127
DAHHYMHHY	−1.7436	17.3052	−1.3885	26.9795
Constant	28.9265**	−858.1762	28.3002**	−735.8187
N	75.0000	75.0000	75.0000	75.0000
F	1.8470	1.2391	2.2330	2.7019
rho		0.1255		0.3158
r2_a	0.0742	−0.0776	0.1045	0.0623

FE*: Significant FE at 5% level
* $p < 0.05$; ** $p < 0.01$; *** $p < 0.001$

shift-share models are similar in their ability to explain variation in poverty. A criticism of Model 1 is that the model compares a discrete measurement (POVRATE) with a measurement that changes overtime (LOCPOVRATE). The explanatory variable (LOCPOVRATE) is a discrete measure, a moment in time. Yet this is being used to explain a change in poverty overtime. This is a mixing of stock and flow variables that represents a limitation of Model 1.

Model 2 accounts for this criticism by using the first difference of the discrete variables in the model specifications. Except for the use of first difference, which is the specification in Model 1, the two models are the same. The regression findings for Model 2 are shown in Table 5.3.

Based on the results from Model 2, the values from the F-test indicate that the specification of Model 2 is statistically insignificant. This implies that the poverty shift-share equation does not explain the poverty variables from Model 2. Findings from Model 2 contradict the findings obtained from Model 1. The results from Model 1 indicate that the explanatory variables were statistically significant; yet the findings from Model 2 indicate the explanatory variables are statistically insignificant. Thus, the new poverty measurement estimated in this research does not really enhance our understanding of poverty.

5.6 Conclusion

Based on the empirical findings presented in Table 5.3, we conclude that shift-share analysis does not improve the explanatory power nor provide any additional information regarding the causes of local poverty. One possible explanation for this finding could be the limited amount of observations and time constraints. Furthermore, time restrictions and absent observations forced many relevant variables to be omitted. The aforementioned omissions could have negatively impacted the empirical results, thus explaining the study's findings. Another possible explanation for the inability of the shift-share approach to add to our understanding of the causes of poverty is the fact that the competitive effect is a residual effect. As such, the competitive effect should have a zero mean which implies that the measure provides no additional information about poverty.

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Part III
Data Issues

Chapter 6
Exploring Explanations for the High Net Undercount of Young Children in the 2010 U.S. Census

William P. O'Hare

6.1 Introduction

There is clear evidence that young children[1] (between the ages of 0–4) were significantly undercounted in the 2010 U.S. Census (O'Hare 2014a, 2015). The Census Bureau's analysis of the 2010 Census reported a net undercount rate of 4.6% for the population age 0–4, which amounts almost one million young children. This net undercount rate was more than twice as high as the next highest undercount rate of 2.2% for age group 5–9 (Hogan et al. 2013). Moreover, research shows that this undercount has increased dramatically since 1980 (O'Hare 2014b).

The net undercount of young children in the U.S. Census is not a new phenomenon. A passage from the 1940 U.S. Decennial Census (U.S. Decennial Census Bureau 1944: 32) stated that the "underenumeration of children under 5 year old, particularly of infants under one year old, has been uniformly observed in the United States U.S. Decennial Census and in the Censuses of England and Wales and of various countries of continental Europe." This observation from more than 70 years ago is still true today.

In one of the few pieces of research prior to the 2010 Census that focused on the undercount of children in U.S. Censuses, West and Robinson (1999: 7) noted that "there have not been systematic attempts to look at reasons for undercounting children." While several new studies of this issue have emerged in the past few years (Griffin 2014; O'Hare et al. 2019a, b; O'Hare 2015; Jensen and Hogan 2017) there is still a lot that is unknown. The research I present in this chapter is an attempt to fill that gap in the literature and to develop a better understanding of the factors responsible for the Census undercount of young children.

[1] In this paper young children refers to children age 0–4.

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There is a dearth of studies on the net undercount of children in the Censuses and fewer still that differentiate among children by age. This lack of studies is a little surprising given the long-standing nature of the problem. A recent re-analysis of historical U.S. Census data showed a significant net undercount of young children in the Censuses of the late 1800s and early 1900s (Hacker 2013). Others (Coale 1955; Coale and Zelnick 1963) have found high net undercount rates for young children in the decennial Censuses as far back as 1880. Genealogical research shows a similar pattern of underreporting young children as far back as the 1850s (Adams and Kasakoff 1991). Clearly the undercount of young children in Censuses is not a new phenomenon.

While there has been a growing recognition of the high net undercount of young children, there is little theoretical understanding about why young children are undercounted at such high rates. In fact, widely accepted theory in survey research indicates that children should not be undercounted at such high rates. In their review of this literature, Groves and Couper (1998: 138) stated that "without exception, every study that has examined response or cooperation finds positive effects of the presence of children in the household." If households with children are more likely to respond to surveys, why then are young children undercounted in the Census at such high rates? It is worth noting that the above review by Groves and Couper does not make any distinction about the age of the children. It is also worth noting that adults in households with young children may respond to the survey (or to the Census), but not include young children in their responses. So, it is conceivable that the common wisdom in survey research and the high net undercount rates for young children are not inconsistent.

Given the size and complexity of the Census-taking operation, it is not likely that there is one simple reason for the high net undercount of young children. However, given the significant size and growing nature of this problem, it is important for demographers to begin presenting and evaluating reasons about why this phenomenon has occurred. Without a clear idea about what factors cause the Census undercount of young children, it is unlikely that the problem can be corrected.

In this chapter. I discuss and evaluate several factors that may be responsible for the high net undercount of young children in the 2020 Census. These factors were selected because they are among those discussed most often and there are data related to the factor. It is likely that many of the potential explanations I discuss related to the 2010 Census also influenced the undercount of young children in earlier Censuses.

6.2 The Undercount of Young Children

I noted earlier that the results of the U.S. Census Bureau's demographic analysis of data from the 2010 decennial Census indicated that young children (age 0–4) had a net undercount rate of 4.6%. This is a rate more than twice as large as that of any other age group. It is also worth noting that young children have a higher omission rate than any other age group. U.S. Census Bureau (2016) researchers estimate that about 2.2 million young children were omitted in the 2010 Census.

Hogan and his colleagues (2013) discussed four different methods that the Census Bureau has used to assess the quality of Census data. Only two of them produce quantitative estimates of net undercounts and overcounts. One of the methods is demographic analysis (DA). DA is a methodology that compares population counts based on Census data with population counts based data sources independent of the Census, such as birth and death certificates, immigration records, Medicare enrollments, and so forth. If the population counts produced with data from the non-Census sources are larger than the counts produced by the Census, this is often seen as an indication that there was undercount in the Census data.

The second method employed by the Census Bureau to measure whether there are undercounts or overcounts in the Census uses data from a survey undertaken after the Census has been conducted. The survey is known as a Post Enumeration Survey. And the method is known as Dual Systems Estimation (DSE).

In general, the results of DA and DSE are fairly consistent with respect to age, with one major exception, namely, that of young children. The 2010 Census is the first U.S. Census that used DSE to provide a net undercount rate for the population under age 5. In the 2010 Census, DA reported a 4.6% net undercount of children age 0–4 compared to a 0.7% net undercount using the DSE methodology. O'Hare et al. (2016) examined the methodological and empirical differences between DA and DSE and concluded that demographic analysis is the preferred method for estimating the undercount of young children because it relies heavily on birth certificate data which are thought to be very accurate (Devine et al. 2010).

Comparing the results of the undercount analyses of data in the 2000 Census using DSE and DA, and noting the generally consistent results, the Census Bureau (2003: v) concluded the following:

> The primary exception to the consistency of results occurs for children aged 0–9. While the … [DSE] estimated a small net overcount for children 0–9 (the estimate was not statistically significantly different from zero), Demographic Analysis estimated a net undercount of 2.56 percent. The Demographic Analysis estimate for this age group is more accurate than those for other age groups because the estimate for young children depends primarily on recent birth registration data which are believed to be highly accurate.

Hogan and his colleagues (2013: 98) also reported that "given the methodology that underlies DA, its estimates of younger populations tend to be quite accurate." Moreover, regarding the best way to measure Census coverage of young children, an internal Census Bureau Task Force on the Undercount of Young Children (Griffin 2014: i) concluded that "that Demographic Analysis (DA) provides the best measure of this undercount in the 2010 Census at 4.6 percent, nationally."

The DA methodology relies heavily on vital statistics which are very accurate in the U.S., particularly for younger populations. This is one reason why the DA methodology is preferred for estimating the Census coverage for young children. In comparing the DA results to the DSE results in the 2000 decennial Census, Zeller (2006: 320) concluded that "since the Demographic Analysis estimate for young children depended on highly accurate recent birth registration data, the Demographic Analysis estimate is believed to be more accurate.".

Figure 6.1 shows the net undercount rates in the 2010 Census for children by single year of age. Three key points may be gleaned from Fig. 6.1. First, the highest net undercount rates are among the youngest children, particularly those under age 5. More than three-quarters of the 1.3 million person net undercount for the population ages 0–17 occurs among those in the 0–4 age group, where the net undercount numbers about one million people.

Second, there is a net overcount rate for persons in the ages 14–17. The net overcount of people age 14–17 is an interesting finding, but it is beyond the scope of this chapter. It should be noted, however, that most of the net overcount of children age 14–17 is due to high net overcounts of Hispanics and Blacks (O'Hare 2015).

Third, there is a very clear age gradient along the age range from age 1 to age 17. The net undercount rate declines steadily from age 1 to age 13, and then in the 14–17 age group turns into a net overcount that becomes increasingly larger with increasing age.

Table 6.1 shows that there was a net undercount of 4.6%, or 970,000 persons, for the population age 0–4 in 2010. Table 6.1 also shows that 0 to 4-year-old Hispanics and Blacks (Alone or in Combination) had substantially higher net undercount rates than others. The official Census Bureau data shown in Table 6.1 indicates a net undercount of 6.3% for young Black (Alone or in Combination) children and 7.5% for young Hispanic children.

Moreover, the net undercount rate for children age 0–4 increased from 1.4% in 1980 to 4.6% in 2010, while the Census coverage rate for adults went from a net undercount rate of 1.4% in 1980 to a net overcount rate of 0.7% in 2010 (O'Hare 2014b). An examination of DA results as far back as the 1950 decennial Census shows a relatively high net undercount for young children (O'Hare 2014b). In fact, for young children the net undercount in the 2010 Census is almost exactly the same as that reported in the 1950 Census.

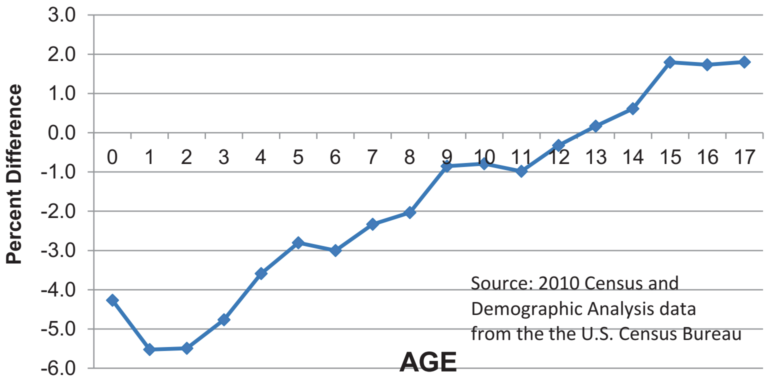

Fig. 6.1 Difference between 2010 census count and DA middle series estimates by singe year of age: age 0–17

Table 6.1 Difference between 2010 decennial census counts and middle series DA estimates for people age 0 to 4, by sex, race and Hispanic origin

	2010 Census count (in 1000s)	2010 DA estimate (in 1000s)	Difference between census count and DA estimate (in 1000s)	Percent difference
Total	20,201	21,171	−970	−4.6
Female	9882	10,353	−471	−4.5
Male	10,320	10,821	−501	−4.6
Black alone	3055	3195	−140	−4.4
Black alone or in combination	3658	3905	−247	−6.3
Not black alone	17,146	17,976	−830	−4.6
Not black alone or in combination	16,544	17,268	−724	−4.2
Hispanic[a]	5114	5528	−414	−7.5
Not hispanic	15,087	15,643	−556	−3.6
Not black alone and not hispanic	12,032	12,448	−416	−3.3
Not black alone or in combination and not hispanic	11,429	11,738	−309	−2.6

Source of Data: Revised DA estimates from the U.S. Census Bureau, May 2012
[a]From 2010 Census DA release

6.3 Explanations for the High Net Undercount Rate of Young Children

Several researchers have addressed the question of why people are missed or counted twice in the Census (de la Puente 1993; Martin and de la Puente 1993; Simpson and Middleton 1997; Schwede and Terry 2013; West and Fein 1990). However, none of these analyses focused on young children.

West and Robinson (1999) have offered three possible reasons why children may not be counted in the Census: (1) Unusual living arrangements involving children make it difficult for the adult respondent to roster the household correctly on the Census form; this may be due to the presence of multiple nuclear families, unrelated children, or stepchildren of the respondent; (2) Limitations of the Census questionnaire make it difficult for the respondent to include children who are likely to be listed last; this would be due to a lack of space on the Census form if the household has many members; (3) A reluctance on the part of respondents to report the presence of children for fear of "negative consequences," such as the loss of eligibility for social services, the deportation of children in the country illegally, or the discovery of a child hiding from a custodial parent.

There are numerous factors and explanations about why young children are missed in the Census. In this chapter, I examine and assess seven different explanations. These seven explanations are among the more popular explanations for the undercount. The seven different explanations that I evaluate are the following:

1. Young children are left off Census questionnaires that have been returned to the Census Bureau by the household, rather than living in households that did not return a Census questionnaire.
2. Unlike other groups, young children do not have a high rate of duplication; that is; they are not likely to have been counted twice which would reduce the net undercount.
3. The age imputation algorithm used by the Census Bureau does not impute enough young children.
4. The structure of the 2010 Census questionnaire results in young children being left off the instrument.
5. Many women have a birth in the U.S. and then take their young child to another country (primarily Mexico) and the emigration is not captured by the Census Bureau DA methodology.
6. Parents with young children in the household experience time pressures that discourage completing the Census questionnaire.
7. A disproportionately large share of young children lives in housing units, households, and families that are hard and difficult to count.

For each of the seven explanations, I present empirical information and endeavor to determine if the available statistical evidence is consistent with a given hypothesis. However, I note that empirical consistency and support are not the same as proof. My results below are thus first steps in an on-going exploration of why there is a high net Census undercount of young children.

1. **Young children are left off Census questionnaires that have been returned to the Census Bureau by the household, rather than living in households that did not return a Census questionnaire.**

A complete evaluation of this explanation would involve decomposing the net undercount. Olson (2009) has posited that any omission in the Census-taking process must come from a failure of one of the following:

- Failure to enumerate the housing unit
- Failure to obtain a complete and accurate roster of household members
- Failure to get information for a person on the roster

The first of these reasons would indicate that the household was not enumerated. The second and third would indicate that the household was enumerated, but that not everyone in the household was included.

Information on the breakout above would be very important to have in any determination of the kinds of changes in Census-taking procedures that would be needed to improve the Census coverage of young children

Two recent studies from the Census Bureau provide some evidence related to what percent of young children missed in the Census were living in households that where the whole housing unit was missed (U.S. Census Bureau 2017a; Fernandez et al. 2018). In the first study (U.S. Census Bureau 2017a) researchers matched data for young children collected in the Post-Enumeration Survey (PES) with records in the 2010 Census. They concluded that only 16% of the records from the PES that did not match the records in the Census were from housing units that were not in the Census. In the second study (Fernandez et al. 2018), Census Bureau researcher matched young children in the Census Bureau's Administrative Records files to Census records and found only 23% of the records that did not match Census records were in households that were not matched.

There is some indirect evidence that is also suggestive. The results of the Census Bureau's Demographic Analysis method shows a net undercount of 4.6%, or 970,000 people, in the ages 0–4 in the 2010 Census. The Census Bureau also found that there was only a 0.6% net undercount of housing units (790,000 units). In addition, there is a widespread belief that the address file used by the Census Bureau in 2010 was better than ever, in part, because of extensive pre-canvasing done by the Census Bureau. This suggests that the very low net undercount of housing units is accurate.

If housing units were counted relatively accurately, but young children had a high net undercount, this would suggest that the high net undercount of young children is more likely due to the children being left off the Census forms that were returned by households rather than their living in housing units that did not return the Census questionnaires.

Also, many researchers have observed that mail return rates are closely related to net undercount rates. Erdman and Bates (2017) found that the percent of the population in a tract that is made up of related children under age 6 was not statistically significantly related to the mail response rate of the tract, controlling for other relevant factors. More recent research (O'Hare et al. 2019a, b) found the mail response rate was not closely related to differences in county level net undercount rats for young children. If young children are largely missed because they are left of returned Census questionnaires, then is it understandable that the presence of young children would not be related to mail return rates.

On the other hand, it is worth noting that Dolson's (2013) study of a reverse record check methodology in the 2011 Canadian Census found that most of the young children who were missed were living in housing units that were missed. It is not clear how much weight to give to this finding because there are significant differences between the U.S. Census and the Canadian Census experiences.

In general, I conclude that the available data support the idea that missed children were more likely to be residing in households that returned a Census forms to the Census, than living in a household that was missed by the Census Bureau.

2. **Unlike many other groups, young children do not have a high rate of duplication; that is; young children are not likely to have been counted twice in the Census.**

Recall that the net undercount figures are a product of omissions, erroneous enumerations (mainly people being included twice), and whole-person imputations. In the 2010 Census, the 0.1% net overcount was the product of 9.9 million erroneous

Table 6.2 2010 Census count, percent duplications, and percent omissions by age

	Census Count (in 1000s)	Percent duplications	Percent omissions
0 to 4	20,158	3.2	6.6
5 to 9	20,315	3.0	4.9
10 to 17	33,430	3.2	4.4

Source: DSSD 2010 Census Coverage Measurement Memorandum Series #2001-G-012010 Census Coverage Measurement Estimates Report: Summary of Estimates of Coverage for Persons in the United States, Table 13 page 20

enumerations, six million whole person imputations, and 16 million omissions (U.S. Census Bureau 2012: Table 6.2). By comparison, the low net undercount rate in 2000 for the total population was a product of 17.2 million erroneous enumerations and 15.9 million omissions (National Research Council 2004: 253).

It is thus possible that the high net undercount of young children is really due to low double counting or erroneous enumerations for this group rather than to a high omission rate. The data about overcounts and undercounts for the 2010 Census come from the DSE. While these data may be suspect with regard to the overall net undercount of young children (see earlier discussions in this chapter), they are all we have available to address the question.

The data in Table 6.2 indicate that the level of duplication for persons of age 0–4 is very similar to persons of age 5–9, and to those of age 10–17. The percentage of persons of age 0–4 that was duplicated in 2010 was 3.2%, compared to 3.0 for age 5–9, and 3.2 for age 10–17.

Also, the data in Table 6.3 indicate that young children (age 0–4) have relatively low rates of duplication compared to other age groups. The data in Tables 6.2 and 6.3 do not support the idea that young children have high net undercount rates because they have low levels of duplication.

First, there is a sentiment expressed by some people that many respondents do not believe that the Census Bureau (or the federal government) wishes to have young children included in the Census counts. This issue has also been mentioned by Schwede and Terry (2013) in their qualitative review and evaluation of the 2010 Census within the context of the public's general distrust of government. The National Association of Latino Elected Official (2018) found that 15% of persons with a young children in the household were not sure that child was supposed to be included in the Census. Second, there is also the belief that many respondents do not want the government to know about the existence of their young children. West and Robinson (1999) have suggested that there may be a reluctance on the part of respondents to report the presence of children for fear of possible "negative consequences" such as loss of eligibility for social services, the deportation of children who are in the country illegally, or discovery of a child in hiding from a custodial parent. This is consistent with a recent paper by Census s Bureau staff identifying different reasons people may not respond the Census (Jeninga et al. 2019).

Given the data suggesting young children are missed in the Census because they are left off the Census form because respondents do not believe the Census Bureau

Table 6.3 Duplicates in the 2010 census by age

	Duplicates found in the Census		All persons enumerated in the census	
Age in Years	Number	Percent	Number	Percent
Under 5 years	447,959	6	20,201,362	6.5
5 to 9 years	526,291	7.1	20,348,657	6.6
10 to 14 years	580,662	7.8	20,677,194	6.7
15 to 19 years	853,916	11.5	22,040,343	7.1
20 to 24 years	878,278	11.8	21,585,999	7
25 to 29 years	465,653	6.2	21,101,849	6.8
30 to 34 years	353,585	4.7	19,962,099	6.5
35 to 39 years	325,561	4.4	20,179,642	6.5
40 to 44 years	335,884	4.5	20,890,964	6.8
45 to 49 years	383,374	5.1	22,708,591	7.4
50 to 54 years	399,302	5.4	22,298,125	7.2
55 to 59 years	378,233	5.1	19,664,805	6.4
60 to 64 years	354,145	4.8	16,817,924	5.4
65 to 69 years	280,943	3.8	12,435,263	4
70 to 74 years	212,999	2.9	9,278,166	3
75 to 79 years	170,811	2.3	7,317,795	2.4
80 years and over	323,127	4.3	11,236,760	3.6
Inconsistent	171,474	2.3	NA	NA
Missing	11,974	0.2	NA	NA
Total	7,454,171	100	308,745,538	100

Source: Heimel and King (2012)

wants them included and that the respondents do not want to put the young children on the Census form, these two notions certainly deserve additional research, both qualitative and quantitative.

The U.S. Census Task Force Report in 2014 (Griffin 2014, page 15) concluded "The population aged 0 to 4 years old does not appear to suffer from a 'lack of duplicates' as much as other age groups such as person in their 30s and 40s."

3. **The age imputation algorithm used by the Census Bureau does not impute enough young children .**

When people fail to provide a valid age on the Census questionnaire, the Census Bureau imputes, substitutes, or allocates a figure for the missing data item. This is done based on known characteristics of the household or the neighborhood. If the Census Bureau imputed, substituted, or allocated too few young children, this would help explain the net undercount of young children.

In the 2010 Census, 3.6% of all people had their age imputed. Table 6.4 shows the percentages of the population of several age groups that had their ages allocated. The population of age 0–4 had age allocated at a slightly lower percent than one would expect based on their overall percentage of the unallocated population. This was true of all ages under age 18. The 0–4 population was 6.6% of the population that did not have their age allocated, but 5.1% of the population with age allocated.

Table 6.4 Distribution of population by age before and after allocation

	NOT Allocated		Allocated		Sum of Allocated and Not Allocated	
	Number (000s)	Percent	Number (000s)	Percent	Number (000 s)	Percent
0 to 4	19,224	6.6	543	5.1	19,767	6.5
5 to 13	35,203	12.1	934	8.7	36,137	11.9
14 to 17	16,379	5.6	422	3.9	16,801	5.6
18+	221,136	75.7	8839	82.3	229,975	76
Total	291,942	100	10,738	100	302,680	100

Source: Griffin 2014, Table 6.4

While it is possible that age misallocation may explain a small part of the high net undercount for young children, age misallocation is not a major reason for the high net undercount of young children. There is no strong evidence that supports the idea that the net undercount of young children is due to serious misallocation of records where age had to be imputed, allocated or substituted.

4. **The structure of the 2010 Census questionnaire results in young children being left off the instrument.**

One possible reason for the high net undercount of young children has to do with construction of the Census questionnaire. West and Robinson (1999) have pointed to issues of the layout of the 1990 and 2000 Census questionnaires that may have made it difficult for a respondent to include all children.

It is important to point out that some of the limitations of the questionnaire used in the 2000 Census have been remedied. In the period between 2000 and 2010, numerous improvements were made to the Census mailout-mailback questionnaire in an attempt to eliminate or minimize these problems (O'Hare 2009). The 2010 Census mail-out questionnaire included a new "administrative' question about people who were left off the roster. The 2010 Census form added an instruction about "including babies" and an instruction about "child custody." One of the most notable improvements was that the main Census questionnaire used in the 2010 Census asked for data on the ages of the 7th through the 12th persons. So even if no follow up occurred with a very large household, the Census Bureau still would have the age of everyone in the household.

In the context of filling out the Census questionnaire, it is important to note that respondents typically fill in the data for the persons in the household, starting with the oldest respondent on the household roster and working down to the youngest person. Wetrogan and Crease (2001: iii) have concluded that "…the children are generally listed after the adults on questionnaires filled out by respondents." Anything that disrupts the completion of the Census questionnaire is likely to have disproportionately greater consequences for children than for adults, and particularly for children under age 5.

On the mailout-mailback Census questionnaire used in the 2010 Census, there is only room for complete demographic information for six people in the household.

There is limited room on the instrument for the names and a few characteristics of the 7th through the 12th person. If more than 12 people lived in the household, the Census Bureau needed to follow up with a call or a visit to the household so to get complete information for these people. But any difficulties collecting data for children in the largest households, i.e., those of 13 or more people, should not be a major factor causing the undercount of young children because few children live in such households. According to ACS data, only 47,000 children under age 5 lived in households of 13 people or more in 2010.

On the form used for Non-Response Follow Up (NRFU) in the 2010 Census, there was only room for data on five people on the primary form. However, the fact that the NRFU form is used by trained enumerators collecting the data in person should overcome this shortcoming with regard to the form.

The limited number of spaces for full information for an individual on the Census form would only be a potential problem for large households, i.e. those with more than 6 people. Analyses based on 2010 ACS data indicated that young children are about three times as likely as adults to be living in large (7+ people) households. The data indicated that 10.1% of young children lived in such large households, compared to 3.5% of adults. Therefore, any problem following-up with these types of households would affect young children disproportionately since they are usually listed last.

Battle and Bielick (2014) have suggested that the inclusion of young children may be particularly sensitive to the way the rostering is done. They found that when a full household screener is used (similar to the Census questionnaire), young children are under-represented relative to using a child screener.

There were substantial improvements in the Census questionnaire between 2000 and 2010, but the net undercount of young children increased slightly between 2000 and 2010. Therefore, I doubt that the form used for data collection in 2010 was a major source of the high net undercount of young children in 2010.

5. **Many women have a birth in the U.S. and then take their young child to another country (primarily Mexico) and the emigration is not captured by the Census Bureau DA methodology.**

Pitkin and Park (2005) argued that the apparent net undercount of young children in California in the 2000 Census was due largely to the net undercount of young children born to foreign-born women. They noted that there may have been no true undercount because many of the children born in California emigrated to another country before the April 1st Census date. If the Census Bureau failed to account for these "emigrants," it would result in the DA population estimates being too high and would thus inflate the undercount rate for children. Pitkin and Park (2005, 10) concluded that "in the absence of comparable Census data for other destination nations it is possible and perhaps not unreasonable to speculate that the missed "children of foreign-bon white …mothers in California have emigrated."

Pitkin and Park (2005) showed that the expected number of children of foreign-born mothers in California based on birth certificate data is 13% higher than the 2000 Census count. However, in their research, they made several debatable assumptions in their identification of the children of foreign-born mothers in the

Census data and they used data from the 1% microdata files, which have significant sampling errors for small groups. Also, at the national level the net undercount rate for Hispanics age 0–4 in 2000 was 7.7%, but the net overcount rate for Hispanic age 10–14 in 2010 was 1.9%. If the net undercount rates of Hispanics age 0–4 in 2000 was due to undetected emigration, one would not expect there to be an overcount of the same age cohort in 2010 when the children had become age 10–14.

It is also worth noting that Pitkin and Park showed an undercount of 12.4% for black children age 0–4 with a foreign-born mother. The emigration arguments they make regarding the children of foreign-born Hispanics and Asians seems less likely to apply to blacks.

However, recent data from the Census Bureau suggest that outmigration of young Hispanics just prior to the 2010 Census, may have been higher than the Census Burau initially assumed. Using an experimental DA method, King et al. (2018) and Jensen et al. (2018a, b) report updated DA estimates based on data from a Mexican Survey shows higher outmigration of young Hispanics than previous data had suggested, The updated estimates, though not official Census Bureau estimates, show a much lower net undercount for young Hispanic children, and a somewhat lower net undercount estimate for all children age 0–4.

Therefore, there is some empirical support for the idea that a significant share of the net undercount of young children in the official Census Bureau estimates was due to the undetected emigration of the young children. The Census Bureau's research on the net undercount of young children following the 2010 Census will help make net undercount estimates for 2020 stronger.

6. **Parents with young children in the household experience time pressures that discourage their completing the Census questionnaire.**

With regard to completing the Census questionnaire, Hillygus et al. (2006: 103) noted that "respondents who are married with children have a lower mail-back rate (83 percent) than those who are married without children (90 percent), suggesting that the time demands of child care work against taking on this particular duty." Data in Table 6.5 show that only 63% of single parents mailed back their Census questionnaire in 2000. Groups with low mailback rates often have high net undercount rates in the Census. Unfortunately, Hillygus and colleagues did not separate out the impact of mailback rates for households specifically with young children (under age 5).

The 2020 CBAMS report (U.S. Census Bureau 2019, page 75) found that only 60% of respondents with a young child in the household said they would respond to the Census, compared to 68% of respondents without a young child in the household, which supports the hypothesis that child care concerns may dampen self-response rates in the Census.

Other data suggest that the propensity to respond to the Census may be impacted by having children in the household. An examination of survey data gathered prior to and during the 2010 Census showed that having two or more children in the household tended to lower the likelihood of respondents saying they would participate in the 2010 Census independent of other factors (Walejko et al. 2011). However, many

Table 6.5 2000 census mail-back rates by presence of children and family types

	2000 census mail-back rate
Live alone	86%
Singe with adult Roomate(s)	73%
Single with child(ren)	63%
Married with no children	90%
Married with child(ren)	83%
Household size	
One-person household	86%
Two-person household	88%
Three-person household	82%
Four or more person household	69%

Source: Hillygus et al. 2006, Table 4.4

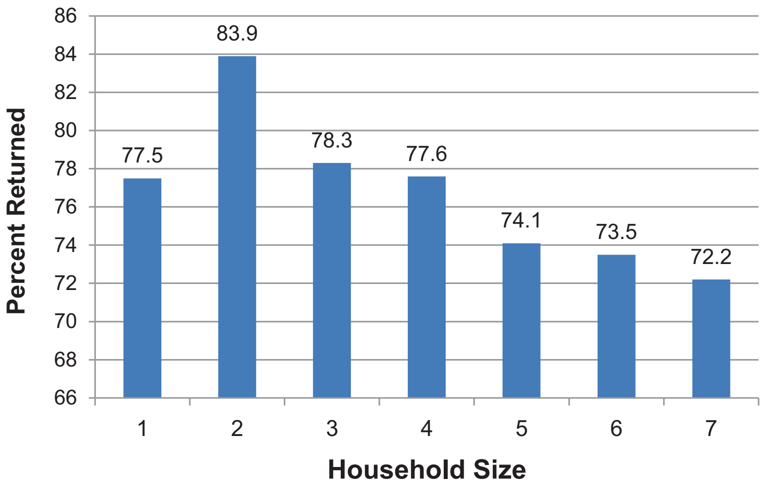

Fig. 6.2 2010 census mail return rate by household size. (Source: Letourneau 2012)

other characteristics are more powerfully associated with participation. Also, this research did not examine the impact of young children (under age 5) separately from that of the impact of all children. And this analysis only focused on the stated intention to participate in the Census, not whether or not the participation actually occurred. Furthermore, the participation of the adult does not necessarily mean that the children in the household would always be included on the Census form.

Unfortunately, the Census Bureau's analysis of mail back rates in the 2010 Decennial Census did not include examination of households by marital status and the presence or age of children in the household (Letourneau 2012). The only piece of data from the 2010 analysis that seems relevant for addressing this question is the mail return rate by size of household (see Fig. 6.2). Data on mail return rates indicate that larger households have lower mail return rates. Presumably, larger households are more likely to have young children, and this is consistent with the hypothesis.

The demands of childcare as a reason for Census nonresponse is consistent with the lower response rates of single parents and the higher net undercount rates of young children. The lower response rates for larger households are also consistent with this explanation. The data support the idea that childcare demands may diminish the likelihood of a household completing the Census questionnaire and thus increase the likelihood that young children will be missed.

7. **A disproportionately large share of young children live in housing units, households, and families that are difficult to enumerate accurately.**

Another hypothesis about why young children are missed in the Census states that disproportionately large numbers of young children live in the kinds of households or living arrangements that are difficult to enumerate. West and Robinson (1999) stated that unusual living arrangements involving children, such as the presence of multiple nuclear families, unrelated children, or stepchildren of the respondent may make it difficult for the respondent to roster the household correctly on the Census form.

The Census Bureau has identified twelve characteristics that are linked to low mail response rates and the likelihood of being missed in the Census (Bruce and Robinson 2007). Although the focus was directed to the identification of Census tracts and blocks that would be difficult to enumerate, many of the factors may also be applied to individuals, families and households. I focus here on ten of the factors.

Table 6.6 shows the percentages of young children and adults according to ten "hard-to-count" characteristics. Of the ten characteristics examined in Table 6.6, young children were more concentrated than adults in eight of them. Moreover, young black or Hispanic children are highly concentrated in these hard to count categories. In many cases, the percentages for young black or Hispanic children in the categories are two or three times those of adults.

In addition to the data shown in Table 6.6, there are many other empirical indications suggesting that young children live in households and families that are difficult to enumerate. This line of research has been updated recently with two reports from the Census Bureau. U.S. Census Bureau researchers (2017b) used data from the 2010 Census to show compare the living arrangements of young children to older children and found that young children were more highly concentrated in the children of families, households, and living arrangements that are more difficult to enumerate accurately. A second U.S Census Bureau study (2017c) used data from the American Community Survey to examine social and economic characteristics of the households and families of young children compared to older children and again found young children more highly concentrated in the types of families and households that are more difficult to enumerate accurately.

One characteristic of young children that may lead to higher undercounts is obvious. Historically, racial and Hispanic minorities have higher Census net undercount rates, and they have disproportionately larger shares of young children. I reported

Table 6.6 Ten of the characteristics from the census Bureau' s planning data base associated with undercounts

	Percent of Adults in this kind of situation	Percent of All Children in this kind of situation	Percent of Children age 0 to 4 in this kind of situation		
			All children	Black	Hispanic
Percent of population living in building with 10+ units	10	7	9	16	15
Percent of the population living in building with 2+ units	21	18	24	43	35
Percent of population living in rental unit	31	38	45	70	60
Percent of population living in crowded households (more than one person per room)	5	14	17	19	35
Percent of population living in something other than husband/wife household	43	34	34	66	38
Percent of housing units with no phone	2	2	3	4	3
Percent of population living below the poverty level	16	23	26	46	36
Percent living in housing receiving food Stamps[a]	12	24	29	54	37
Percent of households living in linguistically isolated households	5	6	8	2	25
Percent of population who moved between 2009 and 2010[b]	15	16	21	37	23

Source: O'Hare 2015, Table 7.2
[a]Planning Data Base uses Public Assistance Income instead of Food Stamps
[b]Data for young children reflect ages 1–4

earlier in this chapter that young black children and young Hispanic children have net undercount rates more than twice as high as others. Also, Edmonston (2001) found even larger such racial gaps for young children based on results of the evaluations of the 1990 Census; also see the analyses of West and Robinson (1999).

Racial/Hispanic minorities (persons other than non-Hispanic whites) increased from 41% of the population age 0–4 in 2000 to 49% in 2010. According to 2010 ACS data, 49% of the population age 0–4 are in a racial/Hispanic group other than non-Hispanic White, compared to only 33% of the adult population (age 18+). Since a larger share of young children is black or Hispanic, and these groups have higher net undercount rates., that may help explain why the net undercount of young children is higher than that of adults.

The Census enumeration is based on the concept of a "usual place of residence." But for some individuals that concept may not be clear. There is clear evidence that marginal attachment to a household reduces the likelihood of being counted; the strength of attachment to a single housing unit or residence varies (Martin 1999, 2007). Many young children fall into this category.

Several recent publications have highlighted the changing living arrangements of children in ways that may lessen their attachment to single housing units (Mykyta and Macartney 2012; Kennedy and Fitch 2012; Kreider 2010). Such major sociodemographic changes need to be taken into consideration in designing any data collection process, such as a Census, that is aimed at counting children. West and Robinson (1999) have suggested that unusual living arrangements involving children, such as the presence of multiple nuclear families, unrelated children, or stepchildren of the respondent may well make it difficult for the adult respondent to roster the household correctly on the Census form.

Table 6.7 provides systematic data on five indicators of household structure and living arrangements. Young children and particularly young minority children are more concentrated in several the kinds of the so-called unusual or complex households shown in Table 6.7.

Table 6.7 shows 14% of young children living in a household with one or more subfamilies compared to only 6% of adults.

Complex living arrangements are also thought to be associated with being missed in the Census. There is evidence that the number of complex households increased in the year prior to the 2010 Census Table 6.7 shows data for young children compared with adults on several measures reflecting living arrangements. In every case,

Table 6.7 Selected living arrangements of children in 2010

	Percent of Adults in this kind of situation	Percent of All Children in this kind of situation	Percent of Children age 0–4_in this kind of situation	Black age 0–4	Hispanic age 0–4
Percent of population living in 3+ generation households[a]	7.4	11	13	20.8	19.4
Percent of population living a household with one or more subfamilies [a]	6.4	9.4	13.5	19.5	19.5
Percent of population in households with more than one family[a]	13.8	11.4	15	15.2	22.3
Percent of population living in cohabiting household		6.8	9.6	10.5	12.4
Percent of children living with neither parent	NA	4.2	3.4	5.8	3.5

[a]Source: 2010 ACS PUMS file analyzed on IPUMS system

young children are more likely than adults to have characteristics that put them in the hard to count category.

A recent report from the U.S. Census Bureau (Jensen et al. 2018a) indicate that 40% of young children lived in a complex household in 2010. Moreover, the share of children in most racial and Hispanic minority groups was much higher than the national figure. The higher share of minority children living in complex families helps explain the higher net undercount for these groups.

It is also worth noting that there are about 500,000 children in foster care at any point in time, and for many of these children their usual place of resident may not be clear (O'Hare 2008). But about half of these are grandchildren living with grandparents, so they are probably included in the Census as grandchildren of the householder rather than a foster child.

Although there are no direct measures of the undercount of immigrants, including undocumented immigrants, it is widely believed that this population is among the most difficult to enumerate. A recent report (Taylor et al. 2011) found that there were over one million unauthorized immigrants who are children (under age 18), and an additional 4.5 million children (under age 18) who were born in the United States to at least one unauthorized immigrant parent. Another study found that nearly half (47%) of unauthorized immigrant households are comprised of couples with children (Passel and Cohn 2009). Yosikawa and colleagues (2014) found that 5.5 million children resided with at least one undocumented immigrant parent. T.

A recent report by the Population Reference Bureau (Jarosz 2018) found young children were more highly concentrated in household with one or more noncitizens than any other age group. One-fifth of children age 0–4 live with one or more noncitizens.

The data suggest that one reason why young children have a high net undercount rate is that they are concentrated in the kinds of living arrangements that leads to people being missed in the Census.

6.4 Summary

The net undercount of people in the ages of 0–4 in the 2010 Decennial Census was far higher than for any other age group. Furthermore, young children (age 0–4) have experienced a high net undercount in each decennial Census for at least the last 60 years. The high net undercount of young children is driven primarily by the high net undercount rates of young black and Hispanic children, which are more than twice as high as the rates for other young children.

From 1950 to 1980, the net undercount rates of young children and adults declined, and the rates were similar. However, after the 1980 Census, the trends for young children began to diverge from those of adults. Following the 1980 Census the net undercounts of adults continued to decrease, but those for young children started to increase. Since 1980 the gap between the undercount rates of adults and young children has been increasing.

In this chapter, I examined several different explanations for the high net undercounts of young children. I showed that the most likely explanation seems to center on the sociodemographic characteristics of young black and Hispanic children. Young black and Hispanic children more than other children tend to live in the types of households and living arrangements that make them more difficult to enumerate. Efforts in future Censuses to reduce the undercounts of young children need to focus on families and households with black and Hispanic children under the age of 5.

This work should be seen as the beginning of a more thorough examination of explanations about why young children have such a high net undercount in the Census. Hopefully, this information will provide some guidance for others who pursue this question.

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Chapter 7
Babies No Longer: Projecting the 100+ Population

Sandra Leigh Johnson and Howard Hogan

7.1 Introduction and Background

As the “babies” of the Baby-Boom continue to age, the oldest will reach age 100 in 2046, which is less than 30 years from now. Just as the number of teenagers grew rapidly in the 1960s, and the number of retirees in the 2010s, we expect that the 100+ population will grow substantially in the 2040s and thereafter. While we know that the aging of the baby boomers will contribute to the future growth in the centenarian population, we do not know exactly how much growth to anticipate. Larger cohorts moving into this age group will inevitably increase the size of this population. However, other factors such as immigration and improvements in survivorship will ultimately determine how much growth we will see in the future 100+ population.

In the last two series of the U.S. Census Bureau’s National Population Projections, concerns have been voiced over the large projected increases in the centenarian population. In the 2012 series, the Census Bureau projected that the 100+ population would increase from 65,000 in 2012 to 690,000 in 2060. In the 2014 series, the Census Bureau projected that the 100+ population would grow from 70,000 in 2014 to 604,000 in 2060. For each of these series, staff at the Census Bureau conducted additional analyses to evaluate the plausibility of the results. Findings, based on comparisons of National Center for Health Statistics (NCHS) and projections life tables, along with time series analyses of the 100+ population, generally suggested

This chapter is released to inform interested parties and encourage discussion of work in progress. The views expressed on statistical, methodological, and technical issues are those of the authors and not necessarily those of the U.S. Census Bureau.

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that these projections of the 100+ population are conceivable. Yet, these projections were questioned internally for the rapid growth in the 100+ population.

In anticipation of this issue arising once more for the 2017 National Projections, we conducted additional research to determine the extent to which our projections of the centenarian population are really cause for concern. Specifically, we have done the following:

1. Conducted a literature review focused on the issue of maximum life expectancy, including the consideration of classic works debating the biological limits to the human life span, as well as more recent studies evaluating the impact of factors such as smoking and obesity on projected life expectancy.
2. Evaluated Census Bureau projections of life expectancy against those of other agencies producing similar products for the United States and for other developed nations.
3. Examined the 2014 mortality inputs and the resulting population projections for potential factors contributing to the increase of centenarians. For instance, is the timing of the increase associated with the entry of the baby boomers into the 100+ ages?
4. Explored historic changes in the centenarian population to provide context for the projected changes; we specifically addressed how the population in this age group changed over time based on the Decennial Census and in the postcensal and intercensal estimates.
5. Tested alternative methods for projecting mortality, comparing these against the results from the 2014 National Projections to evaluate the reasonableness of our current assumptions.

Regarding some of the background of our work, we now note that the debates surrounding projections of the oldest old (i.e., those 85 years and older) and old-age mortality are not unique to the Census Bureau's population projections. Though historical increases in life expectancy over the past two centuries are well documented (life expectancy at birth in developed countries has more than doubled since 1800), there is an ongoing dialogue in the literature regarding the continued pace of improvement in human mortality. Until the mid-twentieth century, the majority of improvements in mortality occurred to children and in the younger adult populations. Given that there is little room for continued reductions to mortality in these ages, the majority of future improvements to mortality will occur at the older ages. Some researchers have suggested that there is no reason to believe that we are approaching a biological limit to human life expectancy (Oppen and Vaupel 2002), and that humans will continue to evolve for longer life (Zhang 2017). Others have argued that substantial increases in life expectancy are unlikely (Carnes and Olshansky 2007).

7.2 Review of Past and Current Projections

Similar methods were used to project mortality rates in the Census Bureau's 2012 and 2014 National Projections. Both series used NCHS-compiled death registration data in conjunction with intercensal estimates produced at the Census Bureau to produce a roughly 20-year time series of mortality rates by age and sex for the following three race and Hispanic origin groups: (1) non-Hispanic Whites and Asians or Pacific Islanders (API), (2) non-Hispanic Blacks and American Indians or Alaska Natives (AIAN), and (3) Hispanics (of any race).

Mortality was projected based on projections of life expectancy at birth (e_0) by sex. Changes in life expectancy at birth by sex were modeled assuming that the complement of the life expectancy (the difference between an upper bound value, A, and the life expectancy values) would decline exponentially. Mortality rates by age were then produced using the most recent observed rates by sex and race-origin group, the trajectory of life expectancy values, and an ultimate life table. To get an ultimate age pattern of mortality by sex, the United Nations' single age versions of the extended Coale and Demeny model life tables were used (United Nations 2010, 2012). The West model mortality rates with life expectancy values of 87 years for males and 91 years for females were selected.

Using the Coale-Demeny West model, age-specific central death rates were then projected for each of the three race-origin groups by sex employing the Census Bureau's Rural-Urban Projection (RUP) program. The RUP algorithm creates life tables for years that have intermediate life expectancy estimates by finding the interpolation factors for the most recent and next death rate inputs that would result in the desired life expectancy at birth value (Arriaga and Associates 2003). The interpolation is done using the logarithms of the death rate values.

For the 2014 series, we made an additional adjustment to the mortality component in response to continued unease about the number of centenarians in the projections. The projections team developed a method to ensure that projections of the 100+ population were not inflated by individuals being allowed to survive to unrealistic ages (i.e., ages older than 115). This method, which assumed an exponential decline in survivorship ratios from age 100 to a value of zero at age 115, was incorporated into the 2014 National Projections.

Looking at the changes in the size of the centenarian population over time shows how this population has increased over time and is projected to continue increasing into the future. Fig. 7.1 presents the centenarian population from the 1980, 1990, 2000, and 2010 Decennial Censuses and from the 2014 National Projections. It shows the number of people in this age group each decade for the years 1980 through 2060 and the proportion of the total population in the age group (per 10,000 people).

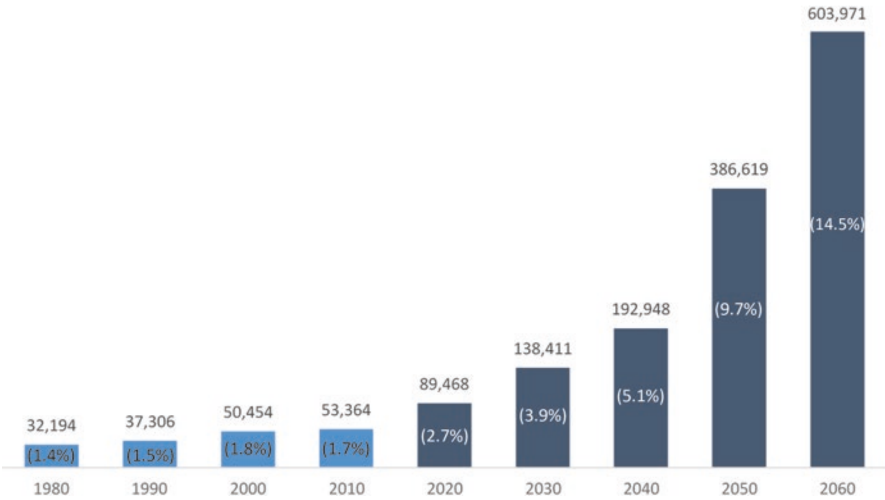

Fig. 7.1 Estimated and projected centenarian population: cohort size and share of total population

Comparisons of census data show that the 100+ population has grown, especially between 1990 and 2000, and that the share of the total population in this age group has increased slightly during this time from 1.4 in 1980 to 1.7 in 2010.

Growth is projected to continue throughout the projection period, with the population of centenarians increasing from 53,364 in 2010 to 603,971 in 2060 in the 2014 series. By the end of the projection period, the proportion of the population aged 100+ per 10,000 people in the population will be 14.5 up from 2.7 in 2020. A decade-by-decade examination shows that the largest increases are projected to occur between 2040 and 2050. During this decade, the 100+ population is projected to double.

Research conducted by the Projections Branch at the Census Bureau suggested that the growth in the 100+ population in the projected years is largely associated with the aging of the Baby Boom cohort. Figure 7.2 shows a line graph of the projected 100+ population through 2060 (left axis) with the size of the associated birth cohorts shown in the bars (right axis). Though the projections of the 100+ population are shown to increase in all the projected years, there is a notable increase expected in 2046, the first year that baby boomers will enter this age group. Because the goal of the research reported in this chapter was to assess the reasonableness of the Census Bureau's projections, we also include projections of the 100+ population from the United Nations (shown with square markers) as reference. The UN projections resemble those of the Census Bureau throughout the projection period.

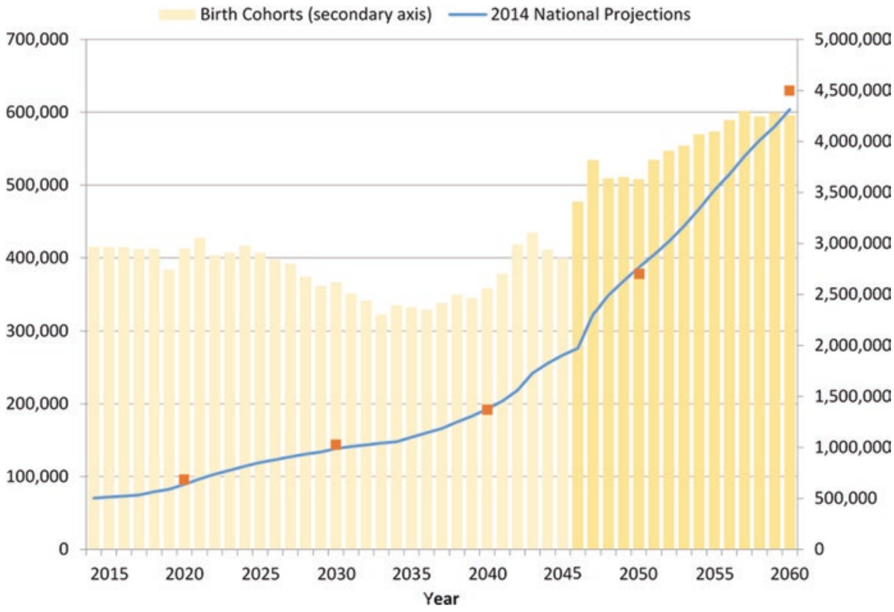

Fig. 7.2 Projected centenarian population in the United States: 2014–2060

7.3 Alternate Research Projections

The projected size of the population of centenarians in 2060 depends fundamentally on three assumptions: (1) the size and composition of the starting population, that is, the population 56 and older in 2014; (2) the size and composition of immigration; and (3) the survivorship ratios for the population 56 and over.

In the following sections, we project the 100 plus population under different assumptions about each of these three components to see which assumptions are key to driving the projected 100 plus population. Each is a based on the 2014 projections for the total population, and is compared with those projections as a benchmark.

7.3.1 Alternate Base Populations

We used the following three scenarios in the projections: (1) zero future net immigration; (2) zero immigration, that is, native-born population only; and (3) no baby boom.

The first two assumptions are largely self-explanatory. However, it is important to note that the zero net immigration assumption allows for the difference between future immigration and future emigration. The zero immigration scenario allows for past emigration of the native-born population. It also includes the native-born children of past immigrants. However, for our illustrative purposes, these are minor limitations.

We test our assumptions on the total projected population by age, but not separately by sex, race, or ethnic group. The same analysis was run separately for females only and yielded similar results (not shown here).

The no baby-boom scenario tests whether the surge in the centenarian population after 2046 can be accounted for by the surge in births in 1946. It is based on a simple geometric interpolation of the 2014 population age 50 with the population age 68, corresponding to the birth cohorts. This tends to smooth out the bump, and reduces the population for those cohorts. Note that very few children born to the baby-boom generation (i.e., the echo-boom) would be born in time to reach age 100 by 2060.

As one can tell from Fig. 7.3 and Table 7.1, the assumptions about future net immigration play only a minor role in the projections of the 100+ population. Zero future net immigration would decrease the projected population by only 3%. Past immigration plays a bigger role. The 100+ projected native population accounts for only 82% of the total number projected, that is a 23% decrease. Assuming no baby boom, however, does decrease the projected number by a similar amount, 23%.

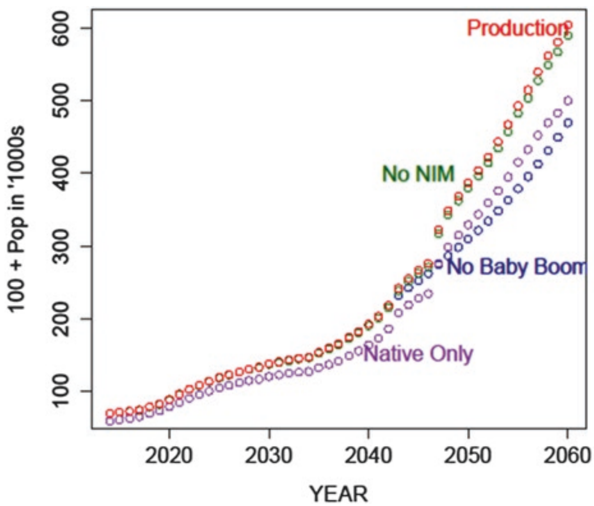

Fig. 7.3 Projections of the centenarian population with alternative assumptions of population base and future net immigration

Table 7.1 Alternative projections of the centenarian population

Series	Projection ('000)	Percent of production	Percent decrease	Incremental decrease
Production estimate	433.7	100	0	
No new net immigration	420.9	97	3	
Native born only	356.5	82	18	
No baby boom	333.0	77	23	
Constant survival 99+	366.2	84	16	16
Constant survival 85+	201.2	46	54	38
Constant survival 75+	182.3	42	58	4
Constant survival 65+	176.7	41	59	1
Constant survival	175.4	40	60	0

7.3.2 Alternate Survivorship Projections

The driver of population projections is, of course, the assumptions about the future survival ratios. In our case, the driver is the assumptions about the increase in survivorship. These are easily tested by holding the survivor ratios constant above certain ages. For example, to look at the importance of the assumption of increased survivorship among the oldest population, we hold the ratios constant at the 2014 levels for ages 99 and over. We then hold them constant for ages 85 and over, 75 and over, and finally, 65 and over.

The results are given in Fig. 7.4 and Table 7.1. The assumption of no improvement in survivorship for those 99 and over has only a modest effect. It would lower the projected number by 16%, comparable with the assumptions about the baby boom.

However, assuming no improvement in survivorship for those over 85 has a dramatic effect, decreasing the projected number by an additional 38%. Assuming constant survival for those over 75, over 65, or for all ages has only a small incremental effect on the projected 100+ population.

Of the scenarios considered, three stand out, namely, no baby boom, no past immigration, and no improvement in survivorship 85 and over. Of these, two are counter factual: there was a baby boom and there was past immigration. Therefore, the key assumption to assess is the survivorship for those 85 and over. How reasonable is this assumption?

The projections assume that female survivorship from 85 to 100 will reach 0.16 by the end of the period. This projection may be assessed against the recent experience of other low mortality countries.[1] The survival ratios are plotted in

[1] The low mortality countries we considered are Australia, Austria, Belgium, Canada, Denmark, Finland, Iceland, Japan, Norway, Sweden, Switzerland, Taiwan, UK. We used data for these countries from the Human Mortality Database.

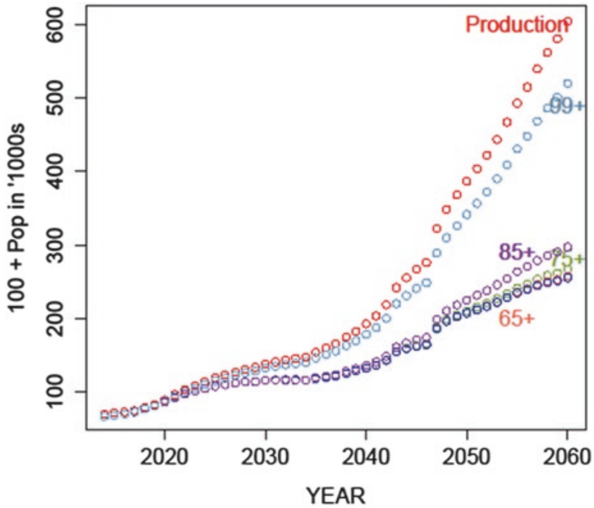

Fig. 7.4 Projections of the centenarian population with alternative assumptions of older age survivorship

Fig. 7.5. The plot is in log-base-2 scale. The horizontal reference line indicates the projected level of survivorship for the end of the period. The vertical line indicates 2014. The United States is plotted in solid triangles; Japan is plotted in hollow circles. All the other countries are plotted with a plus. The plotted data indicate that although it is far from certain that survivorship will reach the projected level by 2020, the trends in our graph give us no indication that this level constitutes an unreasonable assumption.

7.4 Summary and Conclusion

Any projection of what will happen 45 years into the future is almost certainly going to be wrong, perhaps in unexpected ways. Given changes in standards of living, health care, the environment and even human evolution make projections of the centenarian population especially difficult. However, the various sets of projections reported in this chapter all make clear that there will be a substantial increase in the size of the centenarian population. Given the special needs of this population, 45 years is certainly not too far in advance for us to start thinking and planning.

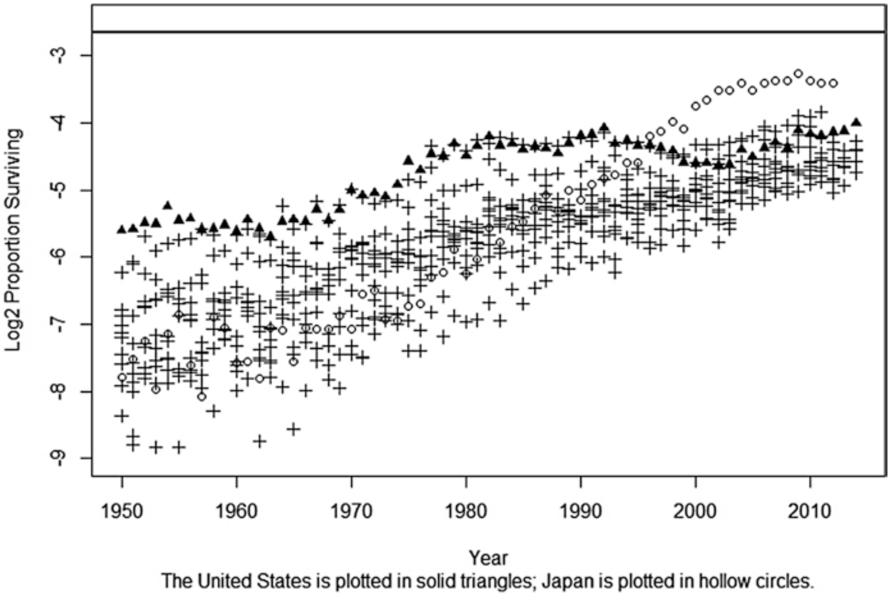

Fig. 7.5 Comparison of trends in other advanced countries

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Chapter 8
Cohort Approaches Using Educational Data of the Czech Republic: Massification of Tertiary Education and Its Impact on Education Attainment

Vladimír Hulík and Klára Hulíková Tesárková

8.1 Introduction

In modern societies, education is one of the key factors for individuals; it is related to personal successes in the labor market, in salary, in health, and in well-being). Education is also very important for society itself, in terms of social cohesion, innovation, racial and religious tolerance, and so on. Human capital as the most important prerequisite for the success of the knowledge-based economy is coming to the forefront of public policies. The European Council adopted the Lisbon Strategy as a complex economic and social strategy in 2000 to respond to the changing global conditions (European Council 2000). The Lisbon Strategy has been followed by the EU 2020 Strategy which emphasized the importance of education as a priority for smart, sustainable and inclusive economic growth. One of the headline targets focuses directly on outputs from education—the share of early school leavers and the share of the younger generation with tertiary education (EC 2010).

There is no general consensus of the definition of human capital. For our purposes the OECD definition can be accepted; it defines human capital as the sum of knowledge, skills, competencies and other attributes which a person possesses and which are related to any economic activity (OECD 1998a).

We can say that human capital is formed and enhanced through the process of lifelong learning in all of its forms – formal and non-formal education and informal

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learning. Because knowledge, skills, and competences acquired in non-formal education and informal learning are very difficult to quantify, it is necessary to focus on formal education as reflected in measurable data, namely, the the education attainment structure of the population (Hulík and Tesárková 2009a).

The education attainment structure of the population in the Czech Republic is the result of the development of the education system in the twentieth century. This development has led to a very high proportion of people with secondary education (with or without access to the tertiary level), and to a very low proportion of persons with primary education or no education and, unfortunately, to a low proportion of people with tertiary education in the population (Hulík and Tesárková 2009a).

Analyses undertaken in the 1990s have shown the effects of demographic developments on the education system, which has led to the changes at all levels of education. After these changes, the education system has become relatively consolidated and its outputs (graduates) can now identify clear trends that are influenced by the demographic development in the Czech Republic. The influence of these trends in the last 20 years can be projected into the future. Moreover, the potential impact of demographic changes on the inputs, outputs and structure of the education system can be identified.

8.2 Research Questions and Goals

Our chapter has two major research questions: One, at what stage, by Trow's definition, is the Czech tertiary system 25 years after the Velvet Revolution? And, two: Can we expect any significant changes in the structure of education attainment of the Czech population up to 2050?

The first question is associated with the OECD expert evaluation, which stated the following in its thematic review of the Czech tertiary system:

> "Looking forward, it is apparent that the Czech tertiary system is approaching a mass system of education – but with persisting inequality" (OECD 2006: 35).

Already with very basic knowledge about the development of the Czech tertiary system after 1989, it seemed impossible that the cohort entry rate was only approaching 15% by the middle of the 2000s.

The second research question is associated with the expected change in the structure of the highest education attainment of the population. If there is a significant change in the education attainment structure, it can be assumed that there will be considerable changes in the society.

Based on available data and the stated research questions our chapter has two main goals:

1. we will analyze the Czech tertiary system according to Trow's theory; and
2. we will introduce the results of the forecast of the education attainment of the population for individual ages in the Czech Republic up to 2050 based on our modelling of the transition intensities.

8.3 Theoretical Background

There are two theoretical concepts that should be kept in mind when studying the tertiary system in the post-communist countries (and specifically in the Czech Republic) and its conditions, possibilities, and development: (1) the theory of the second demographic transition (which among others explains changes in fertility or reproductive behavior since the 1980s); and (2) Trow's conception of tertiary education which describes tertiary systems through entry rates, role in the society, institutional character, academic standards, and other aspects. Both those theoretical approaches will be used in this chapter.

8.3.1 The Second Demographic Transition

The demographic development in the Czech Republic during the 1990s, as well as in many other post-communist countries, typically included a rapid change in fertility as well as in mortality. The mortality change is not crucial for the sector of education, because, among others, the overall level of mortality of children and young persons is very low nowadays as well as during the last decades. On the other hand, there are major consequences of changes in fertility for the education system today as well as in the future.

The year of 1989 is considered to be a revolutionary year in many post-communist countries, and in the Czech Republic. This political threshold is often taken as the beginning of many significant changes referred as the second demographic transition (Lesthaeghe and Van de Kaa 1986). Although there is no general consensus among demographers, the reference is used often to describe the demographic changes represented by rapid fertility decline (Sobotka et al. 2001).

The theory may be summarized with several propositions (Pavlík 2006). The first of them is connected with the end of the "golden age of marriage" representing the decline of traditional forms of cohabitation in favor of unofficial (or unmarried) forms. Moreover, in the families there are fewer children. Those children are no more a cheap labor force as in the past, but they represent an investment for the future. The reasons for these changes include the overall change of values in the society, the impact of individualism and women's emancipation (Pavlík 2006).

Another important feature of the second demographic transition is the shift from a universal family model to various types of family and household structures. There are also changes within the family. Before the onset of the second demographic transition the center of the family and households was the children. During the last decades the parents and childless couples have become the center of the family. A final frequently mentioned feature of the second demographic transition is the change in the perception of contraception, above all of its modern forms. Before the onset of the second demographic transition, the purpose of contraception methods was the limitation of the total number of children; today it is seen as more of a way for family planning (Pavlík 2006).

In the 1960s the second demographic transition was tied above all to the developments in Western or Northern Europe. In that time, those countries experienced substantial economic growth. Modern and reliable methods of contraception became widely available, and the level of mortality was improving. A decade later, similar changes were observed in Southern Europe. But in Central and Eastern Europe this process started mainly in 1990.

With an analysis of the relevant demographic processes it is possible to summarize the trends in the Czech Republic from the 1990s forward. We will follow the same process as in other parts of Europe several decades earlier, but at a more rapid pace. All changes in demographic behavior seemed to be more intensive (Sobotka et al. 2001).

Using the most common demographic indicators, the second demographic transition can be observed via the rapid decline in fertility, the increases in the mean age of mothers at birth, and/or decreases in the level of nuptiality. From the fertility point of view, the process is mostly characterized by the decline of the total fertility rate below the replacement level of 2.1.

Above all, it is the decrease of fertility that has the most important consequences for the educational system. In the Czech Republic the most significant drop in fertility occurred during the 1990s, and the lowest level of fertility was reached in 1999 (the total fertility rate was only 1.13, see Fig. 8.1). The process of the fertility

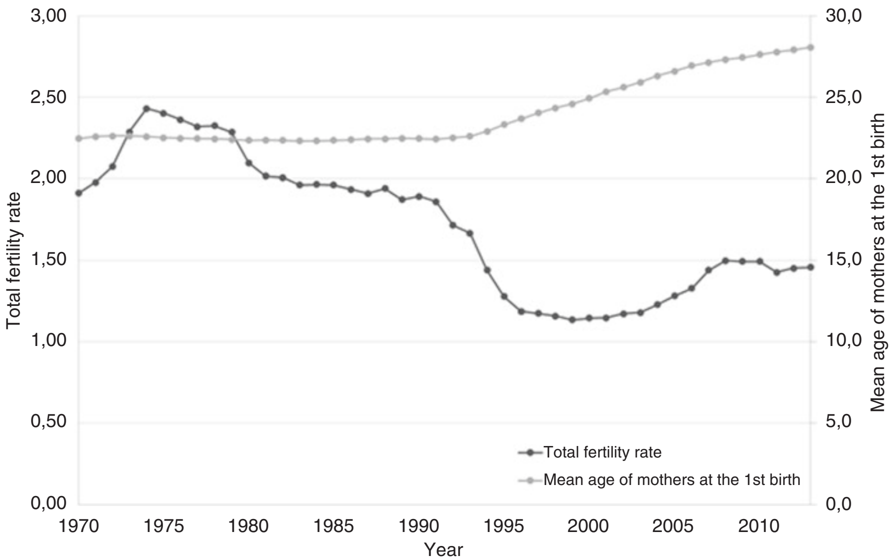

Fig. 8.1 Total fertility rate, mean at of mothers at 1st birth, Czech Republic, 1970–2013. (Source of data: Czech Statistical Office 2014a)

decline was accompanied by a radical increase in the mean age of mothers at birth, especially at first birth. Before the onset of the second demographic transition the mean age at first birth was 22.5 years and started to increase by the mid-1990s (see Fig. 8.1).

Regarding the forecasts of the education system, the most important consequence of the second demographic transition is the decrease of births, which means also the decrease of children or potential students in the upcoming years.

According to the total number of live births in the Czech Republic, Fig. 8.2 shows that the peak fertility occurred in 1974, when the total number of live births was nearly 200,000. On the other hand, some 20 years later this number was less than 100,000. The population cohorts born in the 1970s were a part of the tertiary education system mostly during the 1990s and after 2000. Now, the Czech Republic is facing the smallest cohorts entering tertiary education (see Fig. 8.3).

Because the fertility decline started as early as the 1990s, we can follow the decline in the total number of persons in ages relevant to tertiary education during the past years; however; this decline is likely to continue in the future. The lowest numbers are expected for the year 2023 (Fig. 8.3). This projection of the future should be kept in mind while projecting the development of the tertiary sector.

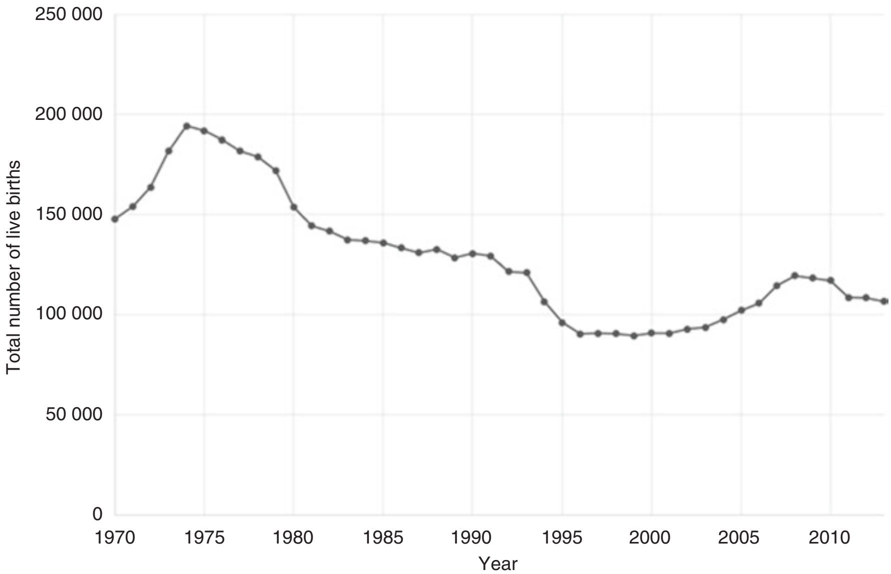

Fig. 8.2 Total number of live births, Czech Republic, 1970–2013. (Source of data: Czech Statistical Office 2014a)

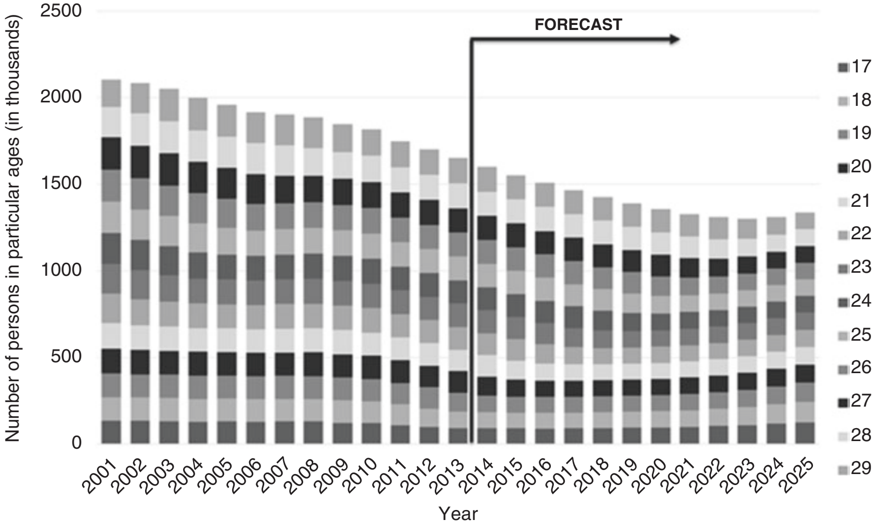

Fig. 8.3 Total number of persons in ages relevant to the tertiary education, Czech Republic, 2001–2025. (Source of data: Czech Statistical Office (2013a, b, 2014b, c, d), the medium variant of the population projection is used)

8.3.2 Trow's Conceptions of Elite, Mass and Universal Higher Education

In 1973, the American sociologist Martin Trow introduced the concept of three forms of higher education (Brennan 2004; Trow 1973, 2005); the concept is still relevant some 40 years later.

According to Brennan and Trow (Brennan 2004: 22, Trow 2005: 1), the forms of higher education as described by the role of tertiary education in the society are:

(i) **elite** – less than 15% of the cohort enters higher education; this results in the shaping of a ruling class and prepares them for elite roles;
(ii) **mass** – 15–50% of the cohort enters higher education; this results in the transmission of skills and prepares the students for a broad range of technical and economic elite roles;
(iii) **universal** – more than 50% of the cohort enters higher education; this results in the adaptation of the entire population to rapid social and technological change.

Of course, the types of students and institutions in each form are different. They vary from closed institutions with high homogenous and common standards and closed campus communities of students in elite forms of tertiary education to much diversified institutions with no common standards and a large number of enrolled people that usually commute to school (see Table 8.1).

Table 8.1 Trow's conceptions of elite, mass and universal higher education

	Elie (0–15%)	Mass (16–50%)	Universal (over 50%)
i) Attitudes to access	A **privilege** of birth or talent or both	A **right** for those with certain qualifications	An **obligation** for the nuddle and upper classes
ii) Functions of higher education	Shaping mind and character of ruling class; preparation for elite roles	Transmission of skills; preparation for broader range of technical and economic elite roles	Adaptation of 'whole population' to rapid social and technological change
iii) Curriculum and forms of instruction	Highly structured in terms of academic or professional conceptions of knowledge	Modular, flexible and semi-structured sequence of courses	Boundaries and sequences break down, distinctions between learning and life break down
iv) The student 'career'	"sponsored" after secondary school; works uninterruptedly until gains degree	Increasing numbers delay entry, more drop out	Much postponement of entry, softening of boundaries between formal education and other aspects of life, term-time working
v) Institutional characteristics	Homogenous with high and common standards	Comprehensive with more diverse standards;	Great diversity with no common standards
	Small residential communities	"Cities of intellect" – mixed residential/ commuting	Aggregates of people enrolled some of whom are rarely or never on campus
	Clear and impermeable boundaries	Boundaries fuzzy and permeable	Boundaries weak or non-existent
vi) Locus of power and decision making	'The Athenaeum' – small elite group, shared values and assumptions	Ordinary political processes of interest groups and party programs	'Mass publics' question special privileges and immunities of academe
vii) Academic standards	Broadly shared and relatively high (in meritocratic phase)	Variable; system/ institution 'become holding companies for quite different kinds of academic enterprises'	Criterion shifts from 'standards' to 'value added'
viii) Access and selection	Meritocratic achievement based on school performance	Meritocratic plus 'compensatory programs' to achieve equality of opportunity	'open', emphasis on 'equality of group achievement' (class, ethnic)
ix) Forms of academic administration	Part-time academics who are 'amateurs at administration'; elected/appointed for limited periods	Former academics now full-time administrators plus large and growing bureaucracy	More specialist full-time professionals. Managerial techniques imported from outside academe
x) Internal governance	Senior professors	Professors and junior staff with increasing influence from students	Breakdown of consensus making institutional governance insoluble; decision-making flows into hands of political authority

Source: coppied from Trow (2005)

Trow (1973) stated that it is not possible to change the form of higher education without also changing the characteristics of institutions of higher education. Thus, it is important for policy makers to know in which form of higher education their system is and where it is going. He stated the following:

> "Countries that develop a system of elite higher education in modern times seem able to expand it without changing its character in fundamental ways until it is providing places for about 15 percent of the age grade. At that point or thereabouts the system begins to change its character; if the transition is made successfully, the system is then able to develop institutions that can grow without being transformed until they reach about 50 percent of the age grade" (Trow 1973: 7).

In the OECD Revision the expansion of tertiary education in OECD countries is faster than Trow's estimations. Experts have noted that it is time to reconsider the border between mass and universal tertiary education (OECD 1998b). We have nevertheless used the original Trow's boundaries in our analysis.

8.3.3 *The Educational Attainment of the Population*

There is a solid theoretical base which can demonstrate the importance of education attainment forecasting. Sen showed the impact of education on overall development (Sen 1999); Bledsoe linked education and fertility (Bledsoe et al. 1999); Alachkar and Serow (1988); and Lleras-Muney (2005) dealt with the relationship between education and mortality. Of course, education has an impact on economic growth (Haddad et al. 1990; Barro and Sala-I-Martìn 1995) and on the other fields of the economy and society. Lutz, Goujon and Wils assumed that in the short run, the positive consequences of education will prevail at an individual level, ranging from higher lifetime income to individual empowerment, and greater social participation, to better health and longevity of the educated persons and their families (Lutz et al. 2005).

Human capital becomes a crucial factor for economic growth in developed countries. Its forecast is key for understanding possible future developments, and it can be marked as an input for all economic and social development scenarios.

8.4 Development of the Czech Tertiary Educational System

The Czech Republic is a country with an extremely large proportion of the population aged 15–64 with at least an upper secondary education; it has the highest share in the EU; it was 87.1% in 2013, compared to 83.8% in 2007 and 80.3% in 2000[1]. But the country has a relatively low proportion of the population with tertiary edu-

[1] Source: Eurostat 2013 (http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database).

cation; it is the fourth lowest in the EU; it was 18.9% in 2013, compared to 10.9% in 2007 and 8.2% in 2000[2].

Due to demographic development in the former Czechoslovakia, especially in the 1970s, on the one hand, and secondary and tertiary education system development in the late 1980s and the 1990s on the other hand, there was a huge discrepancy between the demand and supply of tertiary education in the Czech Republic. We may describe it as a "deferred demand on tertiary education." It usually leads to the situation where the first entry to the tertiary level is postponed into the older ages and generates enormous pressure on the expansion of the tertiary system. For these reasons, we focus on the development of the tertiary sector after the Velvet Revolution in 1989.

Until 1995, only 23 public and 4 state universities were part of the Czech tertiary educational system. The majority of study programs were 5- or 6-year long masters programs ("long masters") that can be classified as level 746 in the ISCED 2011 classification[3] (UNESCO 2011).

In 1996, a new segment of tertiary education in the Czech Republic was introduced. The higher professional schools were established (ISCED 655) in response to the demand for shorter tertiary education more oriented to labor-market needs than to academic knowledge. These programs were usually 2–3 years long.

As a response to changes in tertiary education systems across Europe, the new Higher Education Act was published in 1998. Two major changes had an impact on the scheme of tertiary education in the Czech Republic. Firstly, the new Act enabled the establishment of private universities and, secondly, the three-degree cycle system (Bachelor's Degree, Master's Degree and Doctoral Degree) based on the Bologna Declaration (1999) was implemented at universities.

The segment of the Czech private universities grew rapidly in the first decade of the twenty-first century. In 1999, there were only four private universities, compared to 43 private universities in 2010.

During the same time period of the 2000s, the three-degree-cycle Bologna system was implemented at the Czech universities. In 2000, the majority of students of initial university programs were in long masters (83.4%) with a minority in bachelors (16.6%). After rapid changes in the structure of the study programs, these proportions reversed: in 2010 there was a majority of students in bachelors (84.4%), compared to a minority (15.5%) of students in long masters.

Since the beginning of the new millennium, the Czech tertiary system is in the legislative-stable environment. The university system (92.5% of tertiary students) is relatively homogenous; most study programs are in the Bologna three-cycle mode; only studies of law, medicine and veterinary medicine remain in long master programs. The university study programs are academic-oriented, whereas the study programs of the higher professional schools are more labor-market-oriented.

[2] Source: Eurostat 2013 (http://epp.eurostat.ec.europa.eu/portal/page/portal/statistics/search_database).

[3] International Standard Classification of Education (ISCED) is classification both for education programmes as well as for education attainment.

Although part of the Czech tertiary system consists of conservatoires[4] (the highest two grades), the number of their students and graduates are extremely low compared to the universities and higher professional schools. This segment has been very stable over time, and it is covered in the forecast below as the same absolute number each year.

8.4.1 Indicators of Development of the Czech Tertiary System

Demographic development is a crucial factor for the development of all levels of education systems. Its influence on the number of students enrolled in tertiary education is relatively lower than on the number of students enrolled in other education levels, especially because there is a wider range of learning possibilities in part-time programs focusing on the older population (Hulík and Tesárková 2009b).

We will undertake analysis of the Czech tertiary system using two indicators calculated from individual data, as follows, the entry rate based on cohort analysis, and the net entry rate based on transversal analysis.

The net entry rate is an indicator widely used in international comparisons. But when classifying the tertiary system using Trow's model, it is necessary to calculate the entry rate based on cohort analysis, even though some people from a given cohort can enter tertiary education at a later time. Individual data on tertiary students need to be available.[5]

In the Czech Republic, individual data in longer time series[6] are available only for university students (bachelors – ISCED 645, follow-up masters – ISCED 747, long masters – ISCED 746 and doctorate studies – ISCED 844). Thus only these data are used for entry rate calculations. The entry rates for higher professional schools (ISCED 655) have to be estimated through the total number of enrolled students.

8.4.2 Cohort Entry Rate

The first entry rate can be formally expressed by the following formula (Kleňhová 2007):

$$\sum_{i=0}^{z-y} = \frac{\mathrm{ENTR}\left(z-i,t-i\right)}{\mathrm{POP}\left(z-i,t-i\right)} * 100\%,$$

[4] Art schools focused on music and dancing, ISCED 554. There are around 900 students and around 400 graduates each year.

[5] If it is not, the issue of double-counting usually occurs. From the aggregated statistics we are not able to select students entered into the tertiary level already in the past.

[6] Individual data on university students are collected in the Register of students from 1999.

where *ENTR(z–i,t–i)* is a number of enrolled for the first-time aged *z–i* in the year *t–i*, *POP(z–i,t–i)* is population aged *z–i* in the year *t–i*, *y* is minimal age taken to the analysis, *z* is maximal age taken to the analysis and *t* is year.

8.4.3 Net Entry Rate

The net entry rate can be calculated based on the following formula (Kleňhová 2007):

$$\sum_{a=y}^{a=z} = \frac{\mathrm{NENT}a}{POPa} * 100\%,$$

where *NENTa* is a number of enrolled for the first-time aged *a*, *POPa* is population aged *a*, *y* is minimal age taken to the analysis and *z* is maximal age taken to the analysis and *a* is age.

Following the creation of the European Higher Education Area, the Czech higher education system began to move to a three-cycle degree system (bachelor, master, doctorate). This led to one of the highest growths in tertiary education in the world.

Table 8.2 shows that between 2001 and 2009 the number of first-time enrolled students at universities in the Czech Republic almost doubled, and that there was a significant increase not only in the age groups typical for entry into tertiary education (19- and 20-years-old), but also in the groups over age 30.

A similar picture is shown in Table 8.3 where the entry indicators are calculated. We can pretty much say that the Czech tertiary system changed from elite to mass in the first half of the 1990s. The cohort entry rate show that the cohort aged 18 years in 2004 will probably reach an ultimate total entry rate of 50% (45.4% in 2013). The cohort aged 18 in 2008 will reaching the border of universal tertiary education (48.1%) in 2013.

Based on these data, we conclude that the Czech tertiary system has been in the process of change from mass to universal in the 2000s. And in the middle of the second decade of twenty-first century it is clear that the Czech tertiary system can be definitely described as universal, using Trow's model. The Czech tertiary system remained very homogenous and tertiary institutions did not develop their institutional characteristics, academic standards and governance (Koucký and Bartušek 2011). We assume that this situation exists because the changes of the Czech tertiary system were extremely rapid and extensive. According to Trow's ideas, changes of institutional environment are absolutely necessary and must be done in the very near future for the tertiary system to have a sustainable development (Trow 1973, 2005).

For the future, data on age-specific entry rates are necessary for forecasting tertiary system development. In the situation where the net entry rate declined from 2009 and was stabilized in last 2 years, we assume that the deferred demand on tertiary education was saturated in 2000s and that the net entry rate will be oscillating at around 55%in the future.

Table 8.2 Number of first-time enrolled at universities in the Czech Republic in 2001–2013

	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013
Total	**45 732**	**48 727**	**55 639**	**62 741**	**68 016**	**73 071**	**78 615**	**82 119**	**83 104**	**81 768**	**76 297**	**72 522**	**68 299**
17-	45	63	68	98	89	143	137	150	169	117	126	116	120
18	4 395	1 624	435	543	631	740	842	951	1 119	1 062	1 106	1 154	1 246
19	17 103	16 551	19 779	22 309	23 317	24 768	26 647	26 904	27 901	28 233	25 595	25 293	23 080
20	11 116	14 752	17 075	18 906	21 168	22 175	23 095	24 536	25 006	25 955	25 550	24 744	24 163
21	2 402	3 845	4 278	4 319	4 933	4 972	5 086	5 184	5 410	5 215	5 570	5 533	5 655
22	1 768	1 791	2 009	2 151	2 250	2 558	2 588	2 819	2 816	2 790	2 575	2 541	5 471
23	1 328	1 451	1 435	1 446	1 775	1 845	2 015	2 195	2 179	1 984	1 796	1 717	1 678
24	1 094	1 138	1 200	1 158	1 234	1 337	1 446	1 423	1 472	1 349	1 155	1 036	925
25	825	879	1 059	1 063	1 000	1 004	1 214	1 169	1 135	963	860	700	635
26	719	757	894	1 076	936	978	1 035	996	892	793	685	577	443
27	680	701	807	891	962	1 008	976	970	860	677	575	456	396
28	571	622	727	832	918	1 012	1 069	1 060	828	682	569	445	396
29	446	562	729	825	825	950	1 015	1 058	822	650	541	448	340
30–34	1 426	1 747	2 314	3 174	3 599	4 220	4 756	5 209	4 593	3 718	3 113	2 260	1 763
35–39	981	1 198	1 479	2 010	2 163	2 639	3 214	3 736	3 986	3 759	3 246	2 641	2 290
40+	833	4 046	1 351	1 940	2 216	2 722	3 480	3 799	3 916	3 821	3 235	2 861	2 698

Source: Ministry of Education, Youth and Sports (2014)

Table 8.3 Indicators of the entrance at the Czech universities (net entry rate, cohort entry rate, age- and period-specific entry rates), 1997–2013

Age \ Year	1997	1998	1999	2000	2001	2002	2003	2004	2005	2006	2007	2008	2009	2010	2011	2012	2013	Cohort entry rate
17	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	
18	6,3%	7,0%	7,6%	7,7%	3,3%	1,2%	0,3%	0,4%	0,5%	0,6%	0,7%	0,7%	0,9%	0,9%	0,9%	1,1%	1,3%	
19	6,1%	7,1%	8,2%	9,1%	12,2%	12,3%	14,6%	16,5%	17,5%	18,9%	19,7%	20,5%	21,0%	21,5%	20,7%	20,6%	21,2%	
20	2,7%	2,9%	3,2%	4,5%	7,9%	10,5%	12,5%	13,9%	15,5%	16,5%	17,2%	17,8%	18,8%	19,5%	19,5%	20,0%	19,7%	
21	1,7%	1,6%	1,4%	2,8%	1,6%	2,7%	3,0%	3,2%	3,6%	3,6%	3,7%	3,8%	3,9%	3,9%	4,2%	4,2%	4,6%	
22	1,5%	1,2%	0,9%	1,9%	1,1%	1,2%	1,4%	1,5%	1,6%	1,8%	1,8%	2,0%	2,0%	2,0%	1,9%	1,9%	1,9%	48,1%
23	1,0%	0,8%	0,6%	1,4%	0,8%	0,9%	0,9%	1,0%	1,2%	1,3%	1,4%	1,5%	1,5%	1,4%	1,3%	1,3%	1,3%	
24	0,6%	0,5%	0,5%	1,0%	0,6%	0,7%	0,7%	0,8%	0,9%	0,9%	1,0%	1,0%	1,0%	0,9%	0,8%	0,7%	0,7%	
25	0,3%	0,3%	0,4%	0,6%	0,5%	0,5%	0,6%	0,6%	0,7%	0,7%	0,8%	0,8%	0,8%	0,7%	0,6%	0,5%	0,5%	
26	0,2%	0,3%	0,3%	0,3%	0,4%	0,4%	0,5%	0,6%	0,5%	0,6%	0,7%	0,7%	0,6%	0,5%	0,5%	0,4%	0,3%	45,4%
27	0,2%	0,2%	0,2%	0,2%	0,4%	0,4%	0,4%	0,5%	0,5%	0,6%	0,6%	0,6%	0,6%	0,5%	0,4%	0,3%	0,3%	
28	0,1%	0,2%	0,2%	0,1%	0,3%	0,3%	0,4%	0,5%	0,5%	0,6%	0,6%	0,6%	0,5%	0,5%	0,4%	0,3%	0,3%	
29	0,1%	0,1%	0,1%	0,2%	0,3%	0,3%	0,4%	0,4%	0,4%	0,5%	0,6%	0,6%	0,5%	0,4%	0,4%	0,3%	0,2%	
30–34	0,1%	0,1%	0,1%	0,2%	0,2%	0,2%	0,3%	0,4%	0,4%	0,5%	0,5%	0,6%	0,5%	0,4%	0,4%	0,3%	0,2%	26,8%
35–39	0,1%	0,1%	0,1%	0,1%	0,1%	0,2%	0,2%	0,3%	0,3%	0,4%	0,4%	0,5%	0,5%	0,4%	0,4%	0,3%	0,2%	
40–59	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,0%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	0,1%	
Net entry rate	**21,8%**	**23,4%**	**25,0%**	**31,3%**	**31,5%**	**34,2%**	**39,4%**	**44,7%**	**48,8%**	**52,8%**	**56,1%**	**58,5%**	**59,9%**	**59,5%**	**57,7%**	**56,6%**	**56,5%**	

Source: Czech Statistical Office (2013a, b), Ministry of Education, Youth and Sports (2014), own calculation

Based on calculations from individual students' data of first-entry in the years 2001–2007, we note that in the Czech Republic the drop-out rates from tertiary education are very stable in time; they oscillated between 25% and 30% in the period 2001–2007. In light of this fact, we expect that around 38–42% of this age cohort will obtain a tertiary education at universities in the future.

The last part of this review of the Czech tertiary system will be an evaluation of the development of higher professional schools. Due to the fact that no individual data were available until 2010, we are unable to develop net entry rates or cohort entry rates. We can work only with some available estimates based on the total number of enrolled students and gross graduation rates. From this available information we estimate that around 5–6% of the age cohort will enroll in the higher professional schools and around 2–3% of the age cohort will graduate.

8.5 Educational Attainment Forecast

A population forecast by educational attainment had never been published in the Czech Republic before the year 2009 (Fiala et al. 2009). In cooperation with experts from the University of Economics in Prague, the former Institute for Information on Education, and Charles University in Prague, a project focusing on reproduction of human capital was carried out in 2006–2011. One of the key results wAS forecasts up to 2050 (Langhamrová et al. 2011). We consider highest educational attainment. However, we are aware that this approach does not exactly correspond with actual knowledge, skills, and abilities of individuals.

The population forecast by educational attainment is a derived forecast based on standard population projections of the Czech Republic by age and sex published in 2013 (Czech Statistical Office 2013a, b). The results presented below are based on the middle variant of those population forecasts.

The analysis and forecast presented in this chapter were based on the above cited works (Fiala et al. 2009; Langhamrová et al. 2011) in 2013 when the results of 2011 Census were released and available for research purposes. The first attempt of the population forecast by education attainment (Fiala et al. 2009) was based on the results from the existing forecast of graduates (Hulík 2009; author's internal calculations for the Czech Ministry of Education) and the time-series data of development of the highest education attainment obtained from the European Union Labor Force Survey (EU LFS)[7]. The newly released data from 2011 Census (Czech Statistical Office 2013b) provided an opportunity to compare reality with the fore-

[7] European Union Labor Force Survey (EU LFS) is a large household sample survey providing quarterly results on labor participation of people aged 15 and over as well as on persons outside the labor force. Information on the highest education attainment of participants is also included. National statistical authorities are responsible for data collection in the EU Member States. Access to anonymized individual data (microdata) is restricted and is granted for scientific purposes only (Eurostat 2014).

casted values. According to this comparison, the model shows a significant level of accuracy.

There are five levels of educational attainment reflected in the forecast (with one exception described below):

no education (ISCED 2011 – level 0 or 1)
basic education (ISCED 2011 level 2)
upper secondary education without direct access to tertiary education (ISCED 2011 – levels 353 or 453)
upper secondary education with direct access to tertiary education (ISCED 2011 – levels 344, 354, 444 or 454)
tertiary education (ISCED 2011 – level 5 and higher)

We did not include the level of "no education" in our analysis because based on microdata from the Censuses of 2001 and 2011 (Czech Statistical Office 2003, 2013b) and microdata from the EU LFS 2002–2013 (Czech Statistical Office 2003–2014), there is less than one-half percent of the population without at least a basic education in the Czech Republic. This population is thus combined with those who do have a basic education.

The educational structure of the Czech population as known from the 2001 Census (Czech Statistical Office 2003) was used as the initial base. Levels of educational attainment were distinguished for ages 25 and more.

The results of the forecast are quite interesting, showing significant expected changes. From Figs. 8.4 and 8.5 one can see that the structure of educational attain-

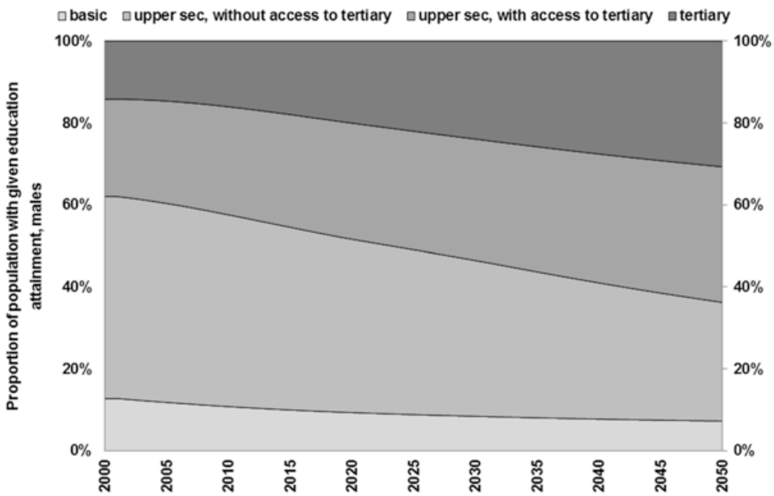

Fig. 8.4 Past and expected future development of education attainment structure of the Czech population, males aged 25 and over, 2000–2050. (Source of data: Czech Statistical Office (2013a), author's calculations)

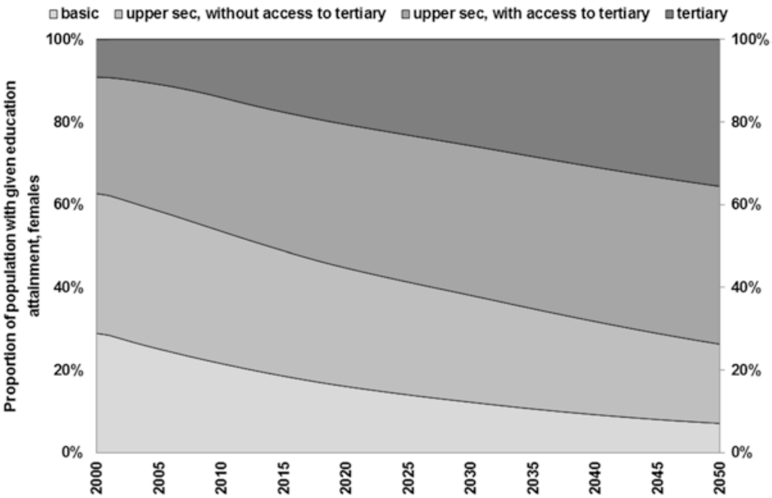

Fig. 8.5 Past and expected future development of education attainment structure of the Czech population, females aged 25 and over, 2000–2050. (Source of data: Czech Statistical Office (2013a), author's calculations)

ment of the Czech males and females will likely be completely different in 2050, compared to the situation in 2000. While in 2000, males showed a higher proportion of tertiary educated and a significantly lower share with basic education only, in 2050 the share of people with only basic education is likely to be almost the same for both genders, and the proportion of women with tertiary education is expected to be higher than the proportion for men. The same holds for the proportion of women with upper secondary education with access to tertiary level of education.

Figures 8.6, 8.7, 8.8 and 8.9 show the influence of the rapid fertility decrease in the 1990s and its almost stable low fertility level in the following period with respect to changes in the structure of educational attainment. The significant shift in educational attainment towards higher education levels is the result of population decreases in the relevant age groups and almost open access to upper secondary education with direct access to tertiary education and tertiary education itself. When the relevant population age groups decreased in size, the number of enrolled students increased. This is also shown by the values of the net entry rates and, above all, by the cohort entry rates (Table 8.4).

It is obvious that the structure of education attainment is likely to completely change in the next 35 years, especially for females. It will probably lead to changes in demographic behavior and outcomes (fertility, mortality, migration), because educational attainment is an important factor influencing reproductive behavior (e.g. Rychtaříková et al. 2014; Basu 2002). Moreover, results of our forecast could be used for further population forecasting where the assumptions could be adjusted even more precisely to the expected changes of the structure of education.

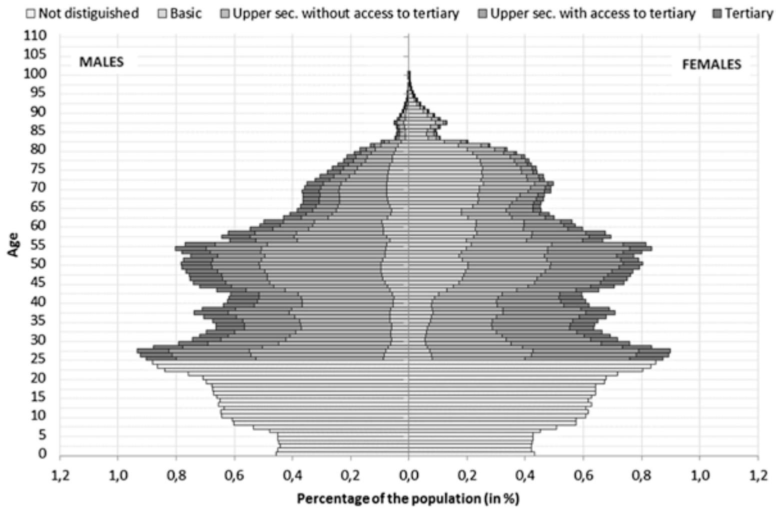

Fig. 8.6 Age, sex and education attainment structure of the Czech population, 2001. (Source of data: Czech Statistical Office 2003)

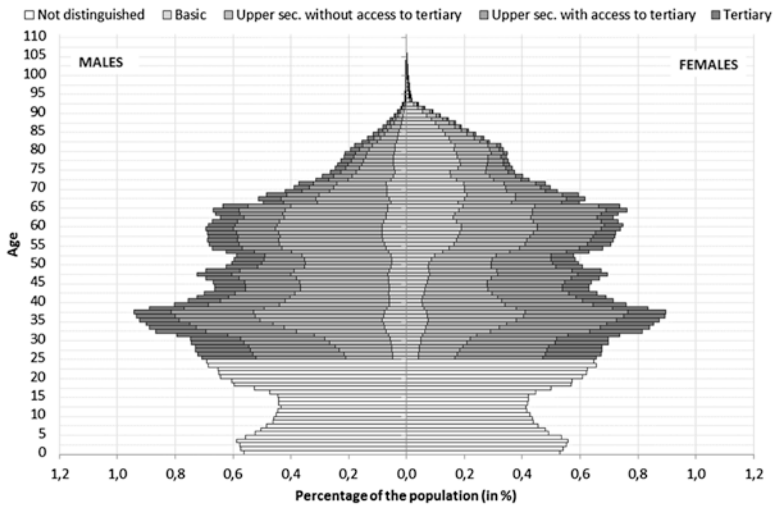

Fig. 8.7 Age, sex and education attainment structure of the Czech population, 2011. (Source of data: Czech Statistical Office 2013b)

Fig. 8.8 Forecasted education attainment structure of the Czech population, 2030. (Source of data: Czech Statistical Office (2013a), author's calculations)

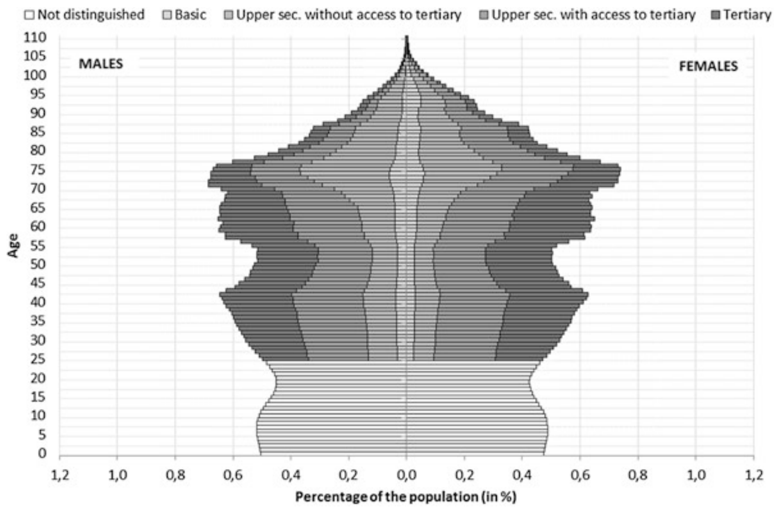

Fig. 8.9 Forecasted education attainment structure of the Czech population, 2050. (Source of data: Czech Statistical Office (2013a), author's calculations)

Table 8.4 Structure of education attainment of the Czech population in 2011 and its forecast for the year 2050 by gender (in %)

	Males		Females	
Education attainment	2011	2050	2011	2050
Basic education (including no education)	10.6	7.3	20.9	7.1
Upper secondary education without direct access to tertiary	46.4	29.0	31.6	19.2
Upper secondary education with direct access to tertiary	26.6	33.0	32.6	38.1
Tertiary education	16.4	30.7	14.8	35.6

Source of data: Czech Statistical Office (2013a), author's calculations

8.6 Conclusion

This chapter has forecast educational attainment in the Czech Republic. The Czech Republic is a typical representative of a post-communist country with huge and rapid changes in terms of population growth as well as the system of education.

Population growth in the Czech Republic during the post-revolutionary period (after 1989) has been characterized by rapid fertility decrease. By the end of the 1990s, fertility reached its lowest level, a TFR of 1.2; at that time the total number of live births was nearly halved compared to the situation some two decades earlier (1970s).

When these smaller cohorts started to enter the education system, the system began to open up, above all at the tertiary level or level of upper secondary education with direct access to tertiary education. The intersection of these two features of the system and population change led to a major increase in entry rates. These rates are expected to remain at a relatively high level because of constant low fertility and continuing changes in the system of education.

Under these assumptions, we forecasted the levels of educational attainment. Our results show that the Czech education system with regard to the tertiary level already follows the form according to Trow's classification model (Trow 1973). Also it is expected that educational attainment of the population of the Czech Republic will continue its shift to higher levels. The proportion of people with only basic education will reach very low levels (of around 7%). And the proportion of persons with upper secondary education with direct access to tertiary education and proportion of tertiary educated people will increase rapidly.

It is clear that these changes will significantly affect the system of education itself as well as the society. The expected changes in the educational structure of the Czech Republic will be significant and similar situation could be expected in other Central European countries that also experienced rapid and large fertility decrease together with the opening of their educational systems.

This situation offers many possibilities for the population, comparable in some way to the potential of the demographic dividend for developing counties. But the full use of the demographic dividend will not come automatically, since in the post-communist Central European countries, including the Czech Republic, there is a question about the future efficient use of their current opportunities and possibilities of future development.

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Part IV
Issues of Health, Aging, and Mortality

Chapter 9
Factors Associated with Female Sterilization in Brazil

Ernesto F. L. Amaral and Joseph E. Potter

9.1 Introduction

In this chapter we analyze factors associated with female sterilization in Brazil. We extend earlier analyses by adding a variable to the survival models that captures the amount of time of exposure to the risk of sterilization. We use data from the 2006 Brazilian National Survey on Demography and Health of Children and Women (PNDS). Our results are of special significance because, among other things, they aid our understanding of Brazil's remarkable decline in fertility from a total fertility rate of 6.3 children per woman in 1960 to 1.9 children per woman in 2010, a fertility rate below the replacement level (IBGE 2012). The increased use of modern contraception is a major factor associated with the fertility decline (Amorim et al. 2008; Berquó et al. 2008; Cavenaghi and Alves 2009; Leone and Hinde 2005; Perpétuo 1998; Perpétuo and Wajnman 2003; Perpétuo and Wong 2009). Of special interest is the fact that the two main contraceptive methods in Brazil are female sterilization and oral contraception (Janowitz et al. 1985; Perpétuo and Wong 2009; Potter 1999; Vieira 2007).

The increases in contraception in Brazil occurred in a context not associated with public policies on birth control (Fonseca Sobrinho 1993). Brazil has most inadequate public services for sexual and reproductive health; they are characterized by excessive "medicalization"; the predominance of the private sector; delayed access to, and inappropriate use of, contraceptives; a lack of medical care; little availability of reversible methods; a high proportion of unwanted pregnancies; and social

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inequality regarding access to contraception (Bilac and Rocha 1998; Giffin and Costa 1999; Miranda-Ribeiro and Simão 2009; Schor et al. 2000; Vieira 2007; Vieira and Souza 2009).

Analyses of female sterilization in Brazil are particularly important and timely for several reasons: (1) about 26% of married or cohabiting women between the ages 15 and 44 were sterilized in 2006; (2) there are legal requirements related to the access of female sterilization; (3) sterilization is for the most part an irreversible contraceptive method; (4) the availability of sterilization is associated with type and place of birth; (5) often there is evidence of regret among women after sterilization has been performed; (6) there is an indication of a frustrated demand for sterilization; (7) the public services for sexual and reproductive health are inadequate in the country; and (8) there is a need to expand the knowledge about female sterilization in Brazil.

Between 2000 and 2010, the main public health and medical journals available in the Scientific Electronic Library Online (SciELO) published only 31 papers about female sterilization in Brazil, out of a total of more than 6000 publications (Minella 2012).

The federal government implemented the family planning law in Brazil in 1997 (Brasil 1996). One of the goals of this law was to make sterilization available in public hospitals, but with restrictions for surgeries during cesarean deliveries, childbirths, and abortions. Law No. 9263 from 1996 stated that "the surgical sterilization of a woman is forbidden during childbirth or abortion, except for health reasons caused by previous successive cesarean deliveries" (Law No. 9,263, Article No. 10, Paragraph No. 2 from January 12, 1996. Article 10 was vetoed until August 19, 1997. Document available on: http://www.planalto.gov.br/ccivil_03/LEIS/L9263.htm) (Brasil 1996). Despite these legal impediments, female sterilization still occurs in conjunction with childbirths and cesarean sections (Barbosa and Knauth 2003; Berquó 1999; Berquó and Cavenaghi 2003; Berquó et al. 2008; Carvalho et al. 2007; Molina 1999; Perpétuo and Wong 2009). Furthermore, the law states that female and male sterilizations are permitted only for persons above the age of 25 years, or for persons with at least two children born alive. Sterilizations may be performed no less than 60 days after the request, so there is time for counseling by a public multidisciplinary health group. Municipalities have insufficient public infrastructures and human resources to perform female sterilizations, and the regulations of the 1997 law appear to restrain the provision of this surgical procedure (Osis et al. 2009).

Empirical evidence has shown that female sterilization has been more prevalent among women at older cohorts, with higher parity, with fewer years of education, with less educated spouses or companions, and among black and indigenous peoples (Amorim et al. 2008). Women with higher levels of education tended to be sterilized after they reached their ideal number of children as a result of planning for a specific number of offspring through the use of temporary contraceptives. By contrast, less educated women tended to be sterilized without having used another contraceptive method and usually after reaching more than the ideal number of children while experiencing shorter birth intervals (Perpétuo and Wong 2009). The option for sterilization seemed to be a result of higher fertility among women who started childbearing early in life (Osis et al. 2003). We turn now to a review of the literature dealing with female sterilization.

9.2 Literature Review

Previous analyses have investigated numerous factors associated with the risk of female sterilization. For instance, marital status (married, cohabiting/in union, not in union) has been shown to be an important factor associated with female sterilization because some women tend to spend a great proportion of their lives outside of marriage or in less stable unions (Godecker et al. 2001). Several studies have shown evidence of some regret of a female sterilization (Cunha et al. 2007; Curtis et al. 2006; Fernandes et al. 2001; Hopkins 2009; Ludermir et al. 2009; Machado et al. 2005; Perpétuo and Wong 2009; Vieira 2007; Vieira et al. 2005). There is also evidence of a frustrated demand for female sterilization (Caetano 2014; Caetano and Potter 2004; Costa et al. 2006; Lacerda et al. 2005; Osis et al. 2009; Potter et al. 2003).

Further, analyses of the differentials in the risk of sterilization have examined the types of delivery (vaginal birth or cesarean section). A large percentage of unnecessary cesarean deliveries have occurred as a way for women to obtain access to sterilization. Since sterilization is more difficult to obtain in the public sector, women might have entered the private sector in order to obtain this procedure, in conjunction with a cesarean delivery (Barbosa and Knauth 2003; Caetano and Potter 2004; Carvalho et al. 2007; Costa et al. 2006; Lacerda et al. 2005; Osis et al. 2009; Potter et al. 2003). There is an extreme inequality regarding access to female sterilization between the public and private sectors (Costa et al. 2006).

The causal relations that exist between cesarean section, female sterilization, and types of hospital are complex. Women who wish to become sterilized might choose a cesarean section at a private hospital where they have easier access to this type of service. Because of this endogeneity issue, we will estimate models later in this chapter that are separated by type of delivery. Furthermore, private hospitals might not directly increase the probability of female sterilization, yet the demand of the contraceptive method has been shown to result in an increase at private hospitals in the selection of cesareans. Thus, we will treat our results as factors associated with female sterilization, instead of as determinants of female sterilization.

Studies about factors associated with female sterilization in Brazil have not considered the effects of different birth intervals (postpartum duration) on the risk of a woman becoming sterilized. Analyses conducted in the United States have estimated models predicting the chances of women having a postpartum or interval sterilization according to race/ethnicity and insurance status (White and Potter 2014). The results have shown that low-income African Americans and Latinas are less likely to undergo female sterilization following childbirth, compared to low-income whites. This might be an indication of the fact that low-income may well minorities experience bureaucratic barriers when seeking to obtain an interval sterilization. We will introduce similar considerations in our Brazilian models, in order to overcome the limitations of preceding analyses. We will add into our survival models the time of exposure to the risk of sterilization. Based on analyses of sterilization in the U.S., our main hypothesis will be that the significant effects of color/race and years of schooling are a result of higher exposed risks to undergo a sterilization procedure among women with higher fertility rates (black and lower educated). When person months of exposure is taken into account, the effects of color/race and years of schooling are expected to lose their significance.

In summary, we will investigate factors associated with female sterilization in Brazil between January 2001 and July 2007. The innovative contribution of this analysis will be the analysis of the effects of different birth intervals on the risk of female sterilization. Our research study is not limited to a cross-sectional investigation. The data are organized by postpartum duration, in order to estimate the risks of sterilization at childbirth (zero months), as well as the risks of interval sterilization (that is, intervals of 1, 2, 3–6, 7–12, 13–18, and 19+ months). In order to conduct this exercise, our models will be controlled for a series of characteristics of women.

In the next section of this chapter, we discuss our data and methods. In later sections we present the main results of our analyses, and discuss our main findings.

9.3 Data and Methods

The data we use in the analyses we undertake in this chapter are drawn from the 2006 Brazilian National Survey on Demography and the Health of Women and Children (PNDS). The subjects of our analyses are women between the ages of 15 and 49 at the time of the interview, who had experienced a live birth between January 2001 and the date of the interview. The data are from four separate questionnaires gathering information on households/individuals (n = 56,365), women (n = 15,575), pregnancy histories (n = 6833), and childbirth histories (n = 27,477). By aggregating the variables from the different databases, our data will refer to pregnancies occurring between January 2001 and July 2007, the specific period that covered the histories of pregnancies and childbirth. Although we will use data from the 2006 PNDS, pregnancies are reported in the database up to July 2007.

We estimate proportional hazard (PH) models predicting the risk of women becoming sterilized (Blossfeld et al. 2007; Blossfeld and Rohwer 2002; Godecker et al. 2001; Leon and Potter 1989; Leone and Hinde 2005; Steele 2003). Several parametric models, e.g., Gompertz models, Weibull models, exponential models, and other parametric models, make strong assumptions about the shape of the hazard function. We estimate Cox semi-parametric models in our analyses because they make no such assumptions. Specifically, piece-wise constant exponential models will be fitted to our data. The hazard is assumed to be constant within pre-specified survival time intervals. But, the constant may well differ for different intervals. The hazard function [$h(t_{ij})$] assesses the risk at a particular moment that an individual who has not yet done so will experience the target event. This specification can be generalized to have a constant hazard within each interval along the survival time axis. In order to accomplish this exercise, the data were reorganized to create several time-varying covariates. Variables were generated to allow the constant term in the hazard regression to differ from interval to interval. The baseline hazard may differ over seven postpartum duration intervals (in months) in which a woman was exposed to the risk of sterilization (0, 1, 2, 3–6, 7–12, 13–18, 19+). A time indicator variable was created for each interval *J*, in the form of seven dummy variables (D_J), to link the episodes in the reorganized data with these time intervals. A set of *P* substantive predictors (X_P) was generated, as individual characteristics, which yield a vector of regression coefficients (β_P). The discrete-time hazard model can be written as follows:

$$\begin{aligned}\operatorname{logit} h(t_j) = {} & [\alpha_0 D_0 + \alpha_1 D_1 + \alpha_2 D_2 + \alpha_{3-6} D_{3-6} + \alpha_{7-12} D_{7-12} + \alpha_{13-18} D_{13-18} + \alpha_{19+} D_{19+}] \\ & + [\beta_1 X_1 + \ldots + \beta_P X_P].\end{aligned} \tag{9.1}$$

The above equation eliminates the subscript *i* for individuals, because its presence is implicit. Moreover, this representation excludes the subscript *j* for time periods from the right side of the equation, because it is either redundant (for the time indicators) or implicit (for the substantive predictors) (Singer and Willett 2003). Each intercept parameter, α_0, α_1, …, α_{19+}, represents the value of the logit hazard (the log odds of event occurrence) in that particular time period for individuals in the baseline groups. Each slope parameter, β_1, β_2, …, β_P, assesses the effect of a one unit difference in that predictor on event occurrence, statistically controlling for the effects of all the other predictors in the model.

All seven duration intervals could be included as covariates if the constant term was excluded. However, we opted to include the constant term, use the one interval of zero months as the reference category. This option provides for us a direct interpretation of how the baseline hazards for the six remaining intervals differ from the reference interval. These two forms of estimation are similar and would generate the same predicted values.

The regression tables produced by estimating our models will report exponentiated coefficients [$exp(\beta_P)$], known as hazard ratios. Graphs will illustrate the cumulative predicted hazards (cumulative probabilities of becoming sterilized). The cumulative hazard function assesses, at each point in time, the total amount of accumulated risk that an individual has faced from the beginning of time until the present.

The steps we follow in estimating the models are the following:

1. Establish the complex survey design (strata and primary sampling unit) and the expansion factor of women (individual weight) using Stata's "svyset" command. The strata are the combined five major regions (North, Northeast, Southeast, Central-West, and South) and household situation (urban and rural). The primary sampling unit is formed by the census tracts (conglomerate).
2. Indicate that this study is based on a survival analysis, with starting and ending times of exposure to the risk of sterilization, as well as note the sterilization

event, with Stata's "stset" command. This initial database utilizes pregnancies as the unit of analysis.

3. Organize the database with postpartum duration (in months) as the unit of analysis by disaggregating pregnancies into the different times that a woman was at the risk of becoming sterilized. Every pregnancy was disaggregated into units of analysis that indicate the exposure of women to a specific postpartum duration. This procedure allows us to check the effects of the time of the exposure of women after delivery/childbirth (postpartum duration) to the event of sterilization. The time of delivery/childbirth (in months) is used to determine the postpartum duration that a woman was exposed to the risk of sterilization, namely, 0, 1, 2, 3–6, 7–12, 13–18, and 19+ months. The computer software compares the initial time of exposure to the risk of sterilization (postpartum period) with the final time of exposure (already calculated) to define how many times each pregnancy will be disaggregated in the database. Stata's "stsplit" command disaggregates the unit of analysis (pregnancy) into the different times that a woman entered the next postpartum period and was exposed to the risk of sterilization. The initial time of exposure is recalculated, considering the final time of the preceding postpartum period for each woman.
4. Indicate, once again, that this study is based on a survival analysis, but now with the ending time of the postpartum period ("stset" command).
5. Estimate piece-wise constant exponential regression models, in order to understand the effect of postpartum periods and other independent variables on the risk of female sterilization, with the "svy: streg, d(exp)" command. These models are estimated using the exponential distribution.

From the initial database with 6833 pregnancies, there were a total of 5890 pregnancies that resulted in live births between January 2001 and July 2007 with valid information for all the variables of interest. However, some cases were dropped from our study. The final database with 3398 pregnancies was disaggregated into postpartum durations. Thus, the unit of analysis is postpartum duration (0, 1, 2, 3–6, 7–12, 13–18, 19+ months) with a total sample size of 17,376 observations. In order to reach this final number, models include only one observation for cases of multiple births (51 births excluded). Women who did not remember their own date of birth (four women), date of sterilization (42 women), or date of delivery/childbirth (one woman) were also excluded. The estimates exclude women who gave birth in health centers (responsible for 94 postpartum records), since none of them were sterilized and would have been automatically dropped from the regression models. Women with deliveries at home were also removed from the analysis (related to 1290 postpartum records), because, obviously, they were not at risk of becoming sterilized because the birth occurred at home without a medical doctor. Women with one child ever born at the time of delivery were not included in the models (corresponding to 13,808 postpartum records), because of their rather small likelihood of becoming sterilized.

Information on female sterilization was used as the dependent variable, considering the month and year of sterilization. The independent variables associated with the risk of female sterilization are listed on Table 9.1. Information on region of residence and years of schooling might change over time. However, the database does not provide data on possible changes, so our variables dealing with residence and schooling pertain to their measurement at the time of interview.

Table 9.1 Independent variables associated with the risk of female sterilization

Independent variables	Categories
1. Postpartum duration in months	0
	1
	2
	3–6
	7–12
	13–18
	19+
2. Woman's age in years at time of delivery	15–24
	25–29
	30–34
	35–49
3. Parity at delivery, calculated with information about number of children ever born and birth order	2 children
	3 children
	4 children or more
4. Place of delivery	Public hospital (SUS)
	Health insurance ("convênio")
	Private hospital
5. Region of residence at the time of interview	North
	Northeast
	Southeast
	Central-West
	South
6. Color/race	White ("branca")
	Black ("preta")
	Brown ("parda")
	Yellow/Asian ("amarela")
	Indigenous ("indigenous")
7. Years of schooling at the time of interview	0–3 (less than first phase of elementary school)
	4–7 (from completed first phase of elementary school to less than second phase of elementary school)
	8–10 (from completed second phase of elementary school to less than secondary school)
	11+ (from completed secondary school and above)

Source: 2006 Brazilian National Survey on Demography and Health of Children and Women (PNDS)

Previous models predicting the risk of sterilization have included information about marital status (married, cohabiting/in union, not in union) (Godecker et al. 2001) and number of unions experienced by women (Leone and Hinde 2005). Our preliminary analyses indicated that married women are more likely to become sterilized than cohabiting women. Also, we found that number of unions did not present statistically significant results. However, we did not include in our analyses information on marital status and number of marriages/unions because they might introduce problems of endogeneity into the regression models.

A total of 100 women reported male sterilization as their form of contraception. However, the date that the vasectomy occurred is not available in the database. Therefore, our models do not estimate the impact of vasectomy on the risk of female sterilization, despite its significance in previous analyses (Oliveira 2003; Oliveira et al. 2009).

We estimated a series of models predicting the risk of female sterilization. Some models took into account only cases concerning cesarean sections or vaginal births, in order to verify differentials in the risk of sterilization by type of delivery. This exercise considered the woman who wanted to become sterilized who gave birth in the private sector in order to have access to this procedure following a cesarean delivery (Barbosa and Knauth 2003; Caetano and Potter 2004; Carvalho et al. 2007; Costa et al. 2006; Lacerda et al. 2005; Osis et al. 2009; Potter et al. 2003).

Five models were estimated examining factors associated with female sterilization. The first three models differed in terms of inclusion of the samples. The first model included all observations in the sample; the second include a subset of the sample with observations related to cesarean section; and the third included a subset related to vaginal delivery observations. All three models included the main effects of all the independent variables noted above.

The other two models tested interactions among the main effects for all the observations in the sample and for cases related to cesarean section. The interaction models did not converge for the subset related to vaginal deliveries, mainly due to small sample size in some categories of postpartum duration (e.g., 0, 1, 2 months). Three sets of interactions were designed: (1) interactions between age at delivery and parity at delivery to account for older women with higher parity possibly witnessing higher risks of sterilization than younger women with lower parity; (2) interactions between place of delivery and postpartum duration to look into whether women in private hospitals have higher chances of getting sterilized during childbirth, comparing to those in public hospitals within zero months after delivery; and (3) interactions between place of delivery and parity at delivery to test whether women within public hospitals (SUS) might been having difficulties to get sterilized even with higher parity, comparing to those with lower parity. Complex survey design was applied to estimate the regression models. All analyses were performed with Stata, version 13.1.

9.4 Results

Our data include women who were exposed to the risk of sterilization for a total of 88,228 months, resulting in 855 women being sterilized between 2001 and 2007 (Table 9.2). As a result of the range of categories used for the postpartum duration (0, 1, 2, 3–6, 7–12, 13–18, and 19+ months), the number of person months of exposure to the risk of female sterilization is the greatest in the 19+ month category (35,632). The number of events of sterilization is most concentrated at the moment of delivery (657 events). In relation to age at the time of delivery, women in the 30–34 year age group have a large number of events of sterilization (202), in comparison to their person months of exposure to the risk of sterilization (13,245), resulting in a percentage of 1.53. Women with two children at delivery have a longer exposure time and more events of sterilization, but a lower percentage (0.70). Women who delivered their babies at private hospitals present an increased incidence of sterilization (167 events) in relation to their person months of exposure (3832 months), representing 4.36%. Women in the North present the most number of events of sterilization, in relation to their person months of exposure (1.28%). In terms of color/race, the majority of the sample is composed of births from brown (51.65%) and white (33.23%) women, with the highest number of sterilization events. Information on educational attainment indicates that women with at least 11 years of schooling have the highest number of sterilization events in relation to their person months of exposure (1.27%).

Table 9.3 illustrates the exponential function of the coefficients from three hazard models. The first model includes all observations in the sample and indicates that the risk of female sterilization is 94% lower [(0.06–1)∗100] in the month following a birth, compared to the risk of sterilization at the same time of delivery. And the risk of sterilization increases with age. For instance, women between 30 and 34 years of age are 3.3 times more likely to become sterilized than women between 15 and 24 years of age. In terms of parity at delivery, women with two children at the time of a birth present the highest risk of being sterilized among all parity groups. In relation to place of delivery, women giving birth at private hospitals have 3.9 higher chances to become sterilized, compared to women at public hospitals (SUS). The coefficients of region of residence suggest that women living in the North are 1.4 times more likely to become sterilized than those living in the Southeast. With regard to color/race, black women are 42% more likely to become sterilized compared to white women. The coefficients for years of schooling were not statistically significant.

Another model was estimated only for observations related to cesarean section delivery (Table 9.3). The hazard ratios for interval sterilization (1+ months) are lower than in the previous model. This is an indication that sterilization at childbirth has been performed in conjunction with cesarean sections. This pattern seems to be happening all over the country, since the region of residence coefficients lost their

Table 9.2 Distribution of births, person months of exposure, and female sterilizations among women delivering live born infants within 5 years of the survey date, Brazil, January 2001–July 2007

Variables	Births	Births (%)	Person months of exposures	Female sterilizations	Sterilizations/ Exposures (%)
Sample size (n)	3398	100,00	88,228	855	0.97
Postpartum duration (months)					
0	—	—	12,975	657	5.06
1	—	—	2731	25	0.92
2	—	—	2667	17	0.64
3–6	—	—	10,001	56	0.56
7–12	—	—	13,195	26	0.20
13–18	—	—	11,027	24	0.22
19+	—	—	35,632	50	0.14
Age at delivery (years)					
15–24	1420	41.79	40,331	230	0.57
25–29	974	28.66	24,991	280	1.12
30–34	586	17.25	13,245	202	1.53
35–49	418	12.30	9661	143	1.48
Parity at delivery					
2 children	1682	49.50	46,586	327	0.70
3 children	889	26.16	21,863	288	1.32
4 children or more	827	24.34	19,779	240	1.21
Place of delivery					
Public hospital (SUS)	2845	83.73	77,226	593	0.77
Health insurance (“convênio”)	287	8.45	7170	95	1.32
Private hospital	266	7.83	3832	167	4.36
Region of residence at the time of interview					
North	735	21.63	16,818	216	1.28
Northeast	639	18.81	16,402	158	0.96
Southeast	646	19.01	17,833	154	0.86
Central-West	677	19.92	20,273	123	0.61
South	701	20.63	16,902	204	1.21
Color/Race					
White (“branca”)	1129	33.23	31,377	266	0.85
Black (“preta”)	340	10.01	8873	76	0.86
Brown (“parda”)	1755	51.65	43,123	473	1.10
Yellow/Asian (“amarela”)	91	2.68	2754	23	0.84
Indigenous (“indígena”)	83	2.44	2101	17	0.81
Years of schooling at the time of interview					
0–3	692	20.36	17,325	168	0.97

(continued)

Table 9.2 (continued)

Variables	Births	Births (%)	Person months of exposures	Female sterilizations	Sterilizations/ Exposures (%)
Sample size (n)	3398	100,00	88,228	855	0.97
4–7	1320	38.85	35,470	301	0.85
8–10	699	20.57	18,668	173	0.93
11+	687	20.22	16,765	213	1.27

Note: This table was constructed without taking into account the complex survey design
Source: 2006 Brazilian National Survey on Demography and Health of Children and Women (PNDS)

statistical significance in this model. It appears that for women with vaginal deliveries, sterilization at childbirth (zero months) happens in a lower level after birth compared to women with cesarean sections, which is probably due to medical recommendations. In terms of parity at delivery, women with two children at the time of a birth present the lowest risk of being sterilized among all parity groups, which is the opposite of our findings in the previous models. In relation to place of delivery, women giving birth with the support of health insurance are 79% less likely to become sterilized than women at public hospitals. The coefficients of region of residence suggest that women living in the North are 1.9 times more likely to become sterilized than women living in the Southeast.

Figure 9.1 illustrates the cumulative predicted hazard of sterilization from the estimated models by postpartum duration and place of delivery for the 25–29 age group, parity of two children, living in the Brazilian Southeast. The predicted hazards show much higher chances of becoming sterilized for women who have a cesarean section, instead of a vaginal delivery. These chances are higher at childbirth, mostly for women having birth in private hospitals with cesarean section. The cumulative hazards do not increase considerably among women with cesarean section, indicating that most sterilization happens at childbirth and not in interval sterilization.

Table 9.4 presents the results for the two models that control for interactions among the independent variables: (1) age at delivery $*$ parity at delivery; (2) place of delivery $*$ postpartum duration; and (3) place of delivery $*$ parity at delivery. The statistical software dropped several categories, due to few observed cases, which tends to increase the standard errors and decrease the statistical significance. In general, region of residence, color/race, and years of schooling have similar results to the main effects model.

In the first model with all observations (Table 9.4), the interactions between age and parity indicate that, among women with two children at the time of delivery, those between 35 and 49 years of age have the highest risk of becoming sterilized (4.5 times more likely), compared to women between 15 and 24 years of age with two children at the time of delivery. Among women with four children or more, those between 35 and 49 years of age have 4.6 higher risks of becoming sterilized, compared to women in the reference category. Interactions between place of delivery and postpartum duration indicate higher risks of sterilization for women giving

Table 9.3 Exponentiated coefficients from hazard models (hazard ratios) estimating the risk of sterilization (main models), Brazil, January 2001–July 2007

Variables	All women	Cesarean Section	Vaginal delivery
Postpartum duration (months)			
0	ref.	ref.	ref.
1	0.06∗∗∗	1.51e-17∗∗∗	0.63
	(0.02)	(1.24e-18)	(0.21)
2	0.06∗∗∗	0.01∗∗∗	0.61
	(0.02)	(0.00)	(0.22)
3–6	0.06∗∗∗	0.01∗∗∗	0.55∗∗
	(0.01)	(0.01)	(0.15)
7–12	0.02∗∗∗	0.01∗∗∗	0.20∗∗∗
	(0.01)	(0.00)	(0.08)
13–18	0.02∗∗∗	0.01∗∗∗	0.11∗∗∗
	(0.01)	(0.00)	(0.04)
19+	0.01∗∗∗	0.01∗∗∗	0.13∗∗∗
	(0.00)	(0.00)	(0.03)
Age at delivery (years)			
15–24	ref.	ref.	ref.
25–29	2.31∗∗∗	2.36∗∗∗	1.37
	(0.38)	(0.48)	(0.34)
30–34	3.26∗∗∗	3.12∗∗∗	1.27
	(0.67)	(0.81)	(0.38)
35–49	3.55∗∗∗	3.12∗∗∗	1.03
	(0.70)	(0.80)	(0.38)
Parity at delivery			
2 children	ref.	ref.	ref.
3 children	0.76∗	0.60∗∗∗	2.02∗∗∗
	(0.11)	(0.10)	(0.51)
4 children or more	0.58∗∗∗	0.53∗∗∗	1.98∗∗
	(0.12)	(0.11)	(0.56)
Place of delivery			
Public hospital (SUS)	ref.	ref.	ref.
Health insurance (“convênio”)	1.43∗	0.89	0.21∗
	(0.29)	(0.18)	(0.19)
Private hospital	3.92∗∗∗	2.20∗∗∗	1.82
	(0.77)	(0.35)	(0.98)
Region of residence at the time of interview			
North	1.35∗	1.08	1.89∗
	(0.22)	(0.20)	(0.71)
Northeast	1.34∗	1.25	1.71
	(0.21)	(0.22)	(0.57)

(continued)

Table 9.3 (continued)

Variables	All women	Cesarean Section	Vaginal delivery
Southeast	ref.	ref.	ref.
South	0.75	0.75	0.53
	(0.14)	(0.14)	(0.22)
Central-West	1.24	1.06	1.22
	(0.19)	(0.167)	(0.48)
Color/Race			
White ("branca")	ref.	ref.	ref.
Black ("preta")	1.42∗	1.23	1.39
	(0.29)	(0.28)	(0.47)
Brown ("parda")	1.20	1.11	1.20
	(0.17)	(0.14)	(0.31)
Yellow/Asian ("amarela")	1.04	1.03	0.30
	(0.33)	(0.32)	(0.29)
Indigenous ("indígena")	1.55	0.58	3.37∗
	(0.79)	(0.20)	(2.16)
Years of schooling at the time of interview			
0–3	0.94	0.82	1.37
	(0.17)	(0.20)	(0.37)
4–7	ref.	ref.	ref.
8–10	1.07	0.92	1.10
	(0.17)	(0.17)	(0.30)
11+	1.03	0.83	1.39
	(0.16)	(0.15)	(0.46)
Model statistics			
Log likelihood	−2444.0	−1110.5	−996.0
Degrees of freedom	24	24	24
Likelihood ratio Chi-Square	2238.8∗∗∗	2434.8∗∗∗	282.9∗∗∗
Survey statistics			
Number of strata	10	10	10
Number of primary sampling units (PSUs)	994	718	789
F-test	F(24; 961) = 48.5∗∗∗	F(24; 685) = 14,044.6∗∗∗	F(24; 756) = 8.9∗∗∗
Number of observations	17,376	5034	12,342

Note: Standard errors within parentheses. The log likelihood and the likelihood ratio chi-square were estimated without taking into account the complex survey design. All other statistics were estimated taking into account the complex survey design. ∗∗∗Significant at $p < 0.01$; ∗∗Significant at $p < 0.05$; ∗Significant at $p < 0.1$

Source: 2006 Brazilian National Survey on Demography and Health of Children and Women (PNDS)

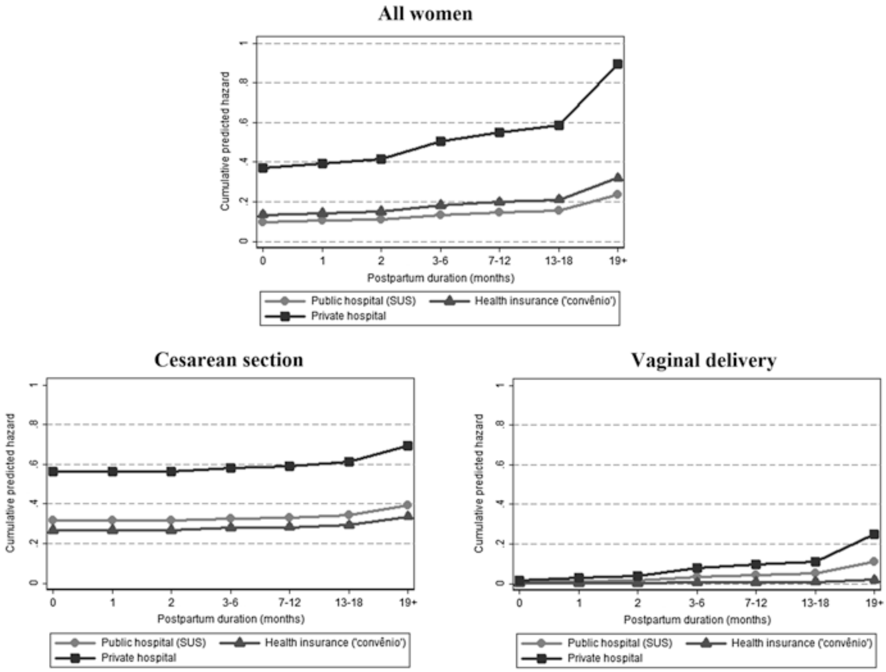

Fig. 9.1 Cumulative predicted hazards of sterilization from models in Table 9.3 by postpartum duration and place of delivery for women in the 25–29 age group, parity of two children, and living in the Brazilian Southeast, January 2001–July 2007

Note: The cumulative predicted hazards were estimated taking into account the complex survey design. The hazards represent the mean across the different color/race and years of schooling categories

Source: 2006 Brazilian National Survey on Demography and Health of Children and Women (PNDS)

birth with the support of health insurance or at private hospitals at the moment of delivery, compared to women in public hospitals within the same postpartum duration. Women within zero months postpartum are 5.3 times more likely to become sterilized if they are in private hospitals, compared to women in the reference category.

Another set of variables evaluates the interaction between place and parity at the time of delivery. At public hospitals, women are less likely to become sterilized if they have four children or more (49% less likely), compared to women with two children.

The second model shown in Table 9.4 has the results for the interactions related to the observations of cesarean section. This model reports the same trends as in the model with all women. However, the hazard ratios for the cesarean section model tend to be smaller than in the previous model. For instance, women within zero

Table 9.4 Exponentiated coefficients from a hazard model (hazard ratios) estimating the risk of sterilization (interaction models), Brazil, January 2001–July 2007

Variables	All women	Cesarean Section
Age at delivery ∗ Parity at delivery		
Age 15–24, 2 children	ref.	ref.
Age 25–29, 2 children	2.78∗∗∗	2.96∗∗∗
	(0.65)	(0.77)
Age 30–34, 2 children	4.19∗∗∗	3.38∗∗∗
	(1.18)	(0.97)
Age 35–49, 2 children	4.51∗∗∗	3.79∗∗∗
	(1.26)	(1.21)
Age 15–24, 3 children	1.07	1.06
	(0.39)	(0.44)
Age 25–29, 3 children	2.41∗∗	2.14∗∗
	(0.86)	(0.81)
Age 30–34, 3 children	3.72∗∗∗	3.51∗∗∗
	(1.48)	(1.64)
Age 35–49, 3 children	3.03∗∗∗	2.83∗∗
	(1.29)	(1.33)
Age 15–24, 4 children or more	2.27∗∗	1.59
	(0.93)	(0.76)
Age 25–29, 4 children or more	3.31∗∗∗	3.23∗∗∗
	(1.25)	(1.31)
Age 30–34, 4 children or more	3.29∗∗∗	3.30∗∗
	(1.28)	(1.60)
Age 35–49, 4 children or more	4.56∗∗∗	3.11∗∗
	(1.53)	(1.38)
Place of delivery ∗ Postpartum duration		
Public hospital (SUS), 0 months	ref.	ref.
Public hospital (SUS), 1 month	0.10∗∗∗	3.32e-18∗∗∗
	(0.03)	(3.96e-19)
Public hospital (SUS), 2 months	0.10∗∗∗	0.01∗∗∗
	(0.03)	(0.00)
Public hospital (SUS), 3–6 months	0.10∗∗∗	0.01∗∗∗
	(0.02)	(0.01)
Public hospital (SUS), 7–12 months	0.04∗∗∗	0.01∗∗∗
	(0.01)	(0.00)
Public hospital (SUS), 13–18 months	0.03∗∗∗	0.01∗∗∗
	(0.01)	(0.01)
Public hospital (SUS), 19+ months	0.02∗∗∗	0.01∗∗∗
	(0.01)	(0.01)
Health insurance (“convênio”), 0 months	1.65	0.75
	(0.94)	(0.41)
Health insurance (“convênio”), 1 month	5.11e-18∗∗∗	2.03e-18∗∗∗

(continued)

Table 9.4 (continued)

Variables	All women	Cesarean Section
	(3.07e-18)	(1.19e-18)
Health insurance ("convênio"), 2 months	0.02***	2.12e-18***
	(0.03)	(1.21e-18)
Health insurance ("convênio"), 3–6 months	0.02***	0.01***
	(0.02)	(0.01)
Health insurance ("convênio"), 7–12 months	5.19e-18***	2.06e-18***
	(3.03e-18)	(1.19e-18)
Health insurance ("convênio"), 13–18 months	5.12e-18***	2.03e-18***
	(3.00e-18)	(1.18e-18)
Health insurance ("convênio"), 19+ months	0.01***	0.01***
	(0.00)	(0.00)
Private hospital, 0 months	5.32***	1.96***
	(1.52)	(0.43)
Private hospital, 1 month	7.23e-18***	2.78e-18***
	(2.41e-18)	(7.20e-19)
Private hospital, 2 months	7.24e-18***	2.80e-18***
	(2.43e-18)	(7.32e-19)
Private hospital, 3–6 months	7.24e-18***	2.80e-18***
	(2.45e-18)	(7.38e-19)
Private hospital, 7–12 months	0.01***	0.01***
	(0.00)	(0.00)
Private hospital, 13–18 months	7.52e-18***	2.84e-18***
	(2.71e-18)	(7.97e-19)
Private hospital, 19+ months	0.01***	0.01***
	(0.01)	(0.00)
Place of delivery * Parity at delivery		
Public hospital (SUS), 2 children	ref.	ref.
Public hospital (SUS), 3 children	0.97	0.73
	(0.35)	(0.27)
Public hospital (SUS), 4 children or more	0.51**	0.46**
	(0.17)	(0.18)
Health insurance ("convênio"), 2 children	1.58	1.39
	(0.84)	(0.75)
Health insurance ("convênio"), 3 children	0.82	0.69
	(0.48)	(0.42)
Health insurance ("convênio"), 4 children or more	Dropped	Dropped
Private hospital, 2 children	Dropped	Dropped
Private hospital, 3 children	Dropped	Dropped
Private hospital, 4 children or more	Dropped	Dropped
Region of residence at the time of interview		

(continued)

Table 9.4 (continued)

Variables	All women	Cesarean Section
North	1.32∗	0.99
	(0.22)	(0.19)
Northeast	1.35∗	1.23
	(0.21)	(0.21)
Southeast	ref.	ref.
South	0.74	0.71∗
	(0.13)	(0.13)
Central-West	1.14	0.95
	(0.18)	(0.16)
Color/Race		
White ("branca")	ref.	ref.
Black ("preta")	1.40∗	1.23
	(0.28)	(0.29)
Brown ("parda")	1.21	1.11
	(0.16)	(0.15)
Yellow/Asian ("amarela")	1.04	1.02
	(0.34)	(0.32)
Indigenous ("indígena")	1.55	0.57
	(0.76)	(0.21)
Years of schooling at the time of interview		
0–3	0.96	0.865
	(0.17)	(0.205)
4–7	ref.	ref.
8–10	1.06	0.90
	(0.17)	(0.17)
11+	1.00	0.82
	(0.16)	(0.15)
Model statistics		
Log likelihood	−2370.9	−1093.4
Degrees of freedom	46	46
Likelihood ratio Chi-Square	2385.0∗∗∗	2469.0∗∗∗
Survey statistics		
Number of strata	10	10
Number of primary sampling units (PSUs)	994	718
F-test	F(46; 939) = 5464.5∗∗∗	F(46; 663) = 15,021.4∗∗∗
Number of observations	17,376	5034

Note: Standard errors within parentheses. The log likelihood and the likelihood ratio chi-square were estimated without taking into account the complex survey design. All other statistics were estimated taking into account the complex survey design. ∗∗∗Significant at $p < 0.01$; ∗∗Significant at $p < 0.05$; ∗Significant at $p < 0.1$

Source: 2006 Brazilian National Survey on Demography and Health of Children and Women (PNDS)

months postpartum are 2.0 times more likely to become sterilized if they are in private hospitals, compared to women in the reference category, in this subset model, while in the overall model this ratio equals 5.3. This is an indication that the chances of sterilization are high among all women having a cesarean section, independent of their characteristics.

9.5 Discussion

The analyses reported in this chapter estimated the risk of Brazilian women becoming sterilized, taking into account the time of sterilization with data on their birth history. Our analyses build on previously estimated models (Godecker et al. 2001; Leon and Potter 1989; Leone and Hinde 2005; Steele 2003; White and Potter 2014). The estimations consider the time of exposure to the risk of female sterilization, as well as the effects of postpartum duration in a longitudinal analysis. Women have a higher risk of becoming sterilized following childbirth, despite the regulations of the 1997 family planning law in Brazil.

One could argue that women are being forced to become sterilized, which might cause regret among them following the procedure (Cunha et al. 2007; Curtis et al. 2006; Fernandes et al. 2001; Hopkins 2009; Ludermir et al. 2009; Machado et al. 2005; Perpétuo and Wong 2009; Vieira 2007; Vieira et al. 2005). However, our models indicate that sterilization is greater among older women, those with two children at delivery, as well as in areas of elevated fertility rates (North and Northeast regions). Women who gave birth at private hospitals or with the support of health insurance were shown to experience the greatest chances of becoming sterilized following a birth. This is an indication that these women may not have been able to become sterilized at public hospitals. Even women with higher-order parity (4+ children) have lower chances of sterilization at public hospitals. Brazil's family planning law allows sterilization only for people above 25 years of age or with at least two children born alive. This might be a reason why women between 15 and 24 years of age, even with two children ever born, were shown to experience low risks of sterilization, compared to women in the other age groups.

The 1997 Brazilian family planning law established restrictions for female sterilization in public hospitals for surgeries during cesarean deliveries, childbirth, and abortion. However, a large percentage of sterilizations has been occurring using health insurance or at private hospitals. Female sterilization has also been shown to occur in combination with childbirth and cesarean section. Women might be going to the private sector in order to be sterilized, following an unnecessary cesarean delivery (Barbosa and Knauth 2003; Berquó 1999; Berquó and Cavenaghi 2003; Berquó et al. 2008; Caetano and Potter 2004; Carvalho et al. 2007; Costa et al. 2006; Lacerda et al. 2005; Molina 1999; Osis et al. 2009; Perpétuo and Wong 2009; Potter et al. 2003). The law could be altered in order to allow female sterilization in conjunction with childbirth (Potter et al. 2003) as a way to address the demand of women in public hospitals.

Previous studies have suggested that higher levels of female sterilization are associated with color/race (higher incidences among black and indigenous women) and with lower levels of educational attainment (Amorim et al. 2008; Perpétuo and Wong 2009). However, our findings suggest that color/race and years of schooling are not very good predictors of the risk of female sterilization, when the models take into account the months of exposure to the risk of sterilization. We only observed an effect for black women, who have higher chances of becoming sterilized than white women. The estimated cumulative predicted hazards of sterilization indicate that black women are not subject to the high risks of sterilization at private hospitals and with the support of health insurance. Black women usually have their births at public hospitals, which may well be due to financial restrictions. As a result, they have risks of sterilization at public hospitals at higher-order postpartum duration (interval sterilization), compared to white and brown women. This is some evidence that black women are not been able to become sterilized at public hospitals at childbirth, probably due to the regulations of the family planning law. White and brown women were shown to experience a higher proportion of births at private hospitals, as well as with the support of health insurance, which resulted in higher cumulative predicted hazards of sterilization among these women.

The high prevalence of sterilization in private institutions should be a concern for the government. Policies are necessary not only to regulate the public sector, but also to provide better and more inclusive services at private institutions. The government needs to implement family planning programs with appropriate health care, guidance, and access to sexual and reproductive health services for all women (Bilac and Rocha 1998; Carvalho et al. 2007; Costa et al. 2006; Giffin and Costa 1999; Miranda-Ribeiro and Simão 2009; Schor et al. 2000; Vieira et al. 2005; Vieira and Souza 2009). Access to more options related to modern contraceptive methods must be provided, as well as appropriate medical follow-ups, which would prevent women from facing the financial and emotional burdens by themselves.

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Chapter 10
Aging and Family Support in the State of Mexico

María Viridiana Sosa Márquez

10.1 Introduction

The demographic transition is characterized by a decline in mortality followed by a decline in fertility, a process that results in changes in the age structure of the population and increases in life expectancy. One of these transformations, to which this chapter pays special attention, is the increasing number of persons aged 60 years and over. In Europe this transition has been largely completed and took place gradually, whereas in Latin America, the transition is still occurring and at a much faster pace.

In 2012 it has been estimated that the number of elderly people in the world was 809 million people, or 11% of the world population; it is expected to 22% by around 2050. Meanwhile, in 2010 the proportion for Latin-American region was 9.9%, and in 2050 it is expected to be 25.8% (CEPAL 2011).

Mexico has a similar scenario. The demographic transition there has been so accelerated that since 1930 the adult population has been increasing constantly. In 2010 the population of 60 years and over comprised 9% of the total population, and it is projected for 2050 to be over 21% (see Table 10.1).

The State of Mexico is the most populous subarea of the country and also has a significant proportion of the population aged 60 years and over. In 1990 the older population represented 4.6% of the total population of this city; by 2000 it had increased to 5.7%; and by 2010 it reached 7.6%. Recent estimates of the National Population Council (CONAPO) project that by 2030 it will be nearly three million seniors representing 14.7% of the total population in the area (see Table 10.2).

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Table 10.1 Population aged 60 and over, Mexico, 2010–2050

Population	2010[a]		2020[b]		2030[b]		2050[b]	
	Population	%	Population	%	Population	%	Population	%
Total	***112,336,538***	***100***	***127,091,642***	***100***	***137,481,336***	***100***	***150,837,517***	***100***
Men	54,855,231	48.8	61,898,147	48.7	66,697,101	48.5	72,888,372	48.3
Women	57,481,307	51.2	65,193,495	51.3	70,784,235	51.5	77,949,144	51.7
Total 60 years and over	***10,055,379***	***9.0***	***14,425,879***	***11.4***	***20,365,839***	***14.8***	***32,427,197***	***21.5***
Men	4,679,538	8.5	6,612,679	10.7	9,200,953	13.8	14,244,660	19.5
Women	5,375,841	9.4	7,813,200	12.0	11,164,886	15.8	18,182,537	23.3

Source: Based on data from [a]INEGI and CONAPO [b](Population projections updated at November 29, 2012)

Table 10.2 Population aged 60 and over, State of Mexico, 2010–2030

Population	2010[a]		2020[b]		2030[b]	
	Population	%	Population	%	Population	%
Total	***15,175,862***	**100**	***18,075,065***	**100**	***20,167,433***	**100**
Men	7,396,986	48.7	8,834,764	48.9	9,860,611	48.9
Women	7,778,876	51.3	9,240,300	51.1	10,306,822	51.1
Total 60 years and over	***1,137,647***	***7.5***	***1,917,767***	***10.6***	***2,972,420***	***14.7***
Men	521,277	7.0	878,243	9.9	1,345,188	13.6
Women	616,370	7.9	1,039,524	11.2	1,627,232	15.8

Source: Based on data from [a]INEGI and CONAPO [b](Population projections updated at November 29, 2012)

Fig. 10.1 Population pyramids, Mexico, 2015, 2025, and 2050. (Source: Data and population projections from CONAPO (CONAPO 2012))

As it is shown in Fig. 10.1 the evolution of the structure of population by age and sex of Mexico will change significantly between 2015 and 2050. There will be a decrease in the proportion of the population of younger age, a significant growth of the elderly, and a maintenance of the population who, according to their age, can become economically active.

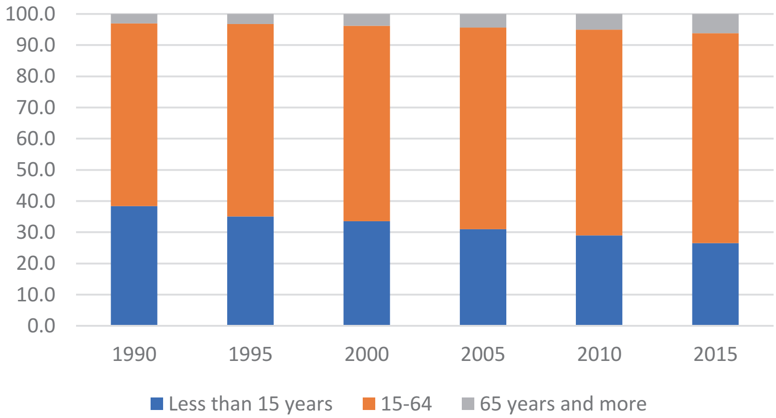

Fig. 10.2 Population by large age groups (%), Mexico 1990–2015. (Source: Population census, counts and Intercensal survey (INEGI 2016a, b))

The situation of having a large number of people of age 60 years and older, with projected increases of them in the years ahead, is a challenge we have to face as a society. We need to ask about the risks that this increase of population implies; these include a decline in their abilities, their health condition, their financial support and the social support they will need. This situation will likely need an intervention to maintain the quality of life for this population.

We note that the most relevant changes in the structure of the population of Mexico between now and the year of 2015 are the decreasing proportion of population under 15 years and the increasing proportion of those 65 years and over. Figure 10.2 illustrates the need to rethink care arrangements for the elderly and the way the future social security system needs restructuring.

The role that families of older people play in maintaining their welfare is clear and traditional; aging usually refers to the deterioration of abilities and health, as well as income, making the elderly dependent socially and economically on their families. The support that social networks, family or friends, can provide is reflected in the co-residence and monetary or affective transfers. However, the increasing incorporation of women into the labor market, the decline in the number of children that women have, and the state's inability to meet the needs of this population, all could well lead to a weakening of the support networks of the elderly (Arriagada 2005).

The aim of this chapter is to describe the current status of the population 60 years and over in the State of Mexico, with special attention given to families. A number of variables and indicators will be examined to provide a broad description of the conditions of the elderly. We will provide information on the dependency ratio, household type of residence, number of household members, and marital status disaggregated by sex. All the data are from the 2010 Mexican Census of Population and Housing.

10.2 Background

Traditionally, children in Mexico, as in most countries, are expected to help their elderly parents when they can no longer carry out their daily activities independently. With inadequate financial support and medical services, there is an increased pressure on families to ensure the welfare of a growing number of adults.

There is a rich literature that indicates that it is usually the need for support of and care for older adults that triggers intervention by children (Herrera and Fernández 2013). Older adults tend to receive various forms of support, but having a partner or children is the most important factor that determines the actual delivery of this support in times of need.

Most believe that the more valuable resources for coping with unfavorable circumstances requiring assistance are work, family, and personal savings. Also, most Mexican elderly know that support from the State is usually inadequate as a mechanism of protection. One can argue that the welfare of the elderly depends on their relationships with the different institutional spheres of the market, the state, the family and community organizations. Owing to the failure of the first two spheres in Mexico, the importance of the family to meet the needs of the elderly is unquestionable.

We usually think of the population aged 60 years and over as a group that has ceased to be productive, or at least has greatly reduced the amount of their labor force participation. Once this is accompanied by some deterioration in their physical abilities and, in many cases, a lack of income, the elderly become dependent on others. It is at this point that the family becomes a source of support, given the absence of adequate public health services and sufficient retirement systems in Mexico (Hakkert and Guzmán 2004).

As we have noted, the fertility declines lead to impacts on family size along with decreased mortality, and both result in an increase of people's life expectancy and in a greater number of persons 60 years of age and older. This decrease in births also results in the stress on the now smaller number of family members on whom the responsibility falls for caring for the elderly.

In Latin America less than one-half of the urban population 60 years and over is a beneficiary of social security, versus only 38% in rural areas. And this inadequate coverage is accompanied by a steady decline in the number of family members. This raises the question of who will be responsible for providing support and care for older adults in times of illness or disability. Currently, in Latin America and the Caribbean, only 8.4% of the population is over 60 years. Despite this relatively low percentage of the elderly population, the proportion of urban households with at least one older adult varies from 21% in Mexico to 49% in Uruguay. At the same time, the percentages of elderly living alone are high.

According to various studies, in Mexico assistance to the older population is presented through different ways, some of which appear as informal support networks where the closest family and friends are often the handiest. Co-residence of the elderly with their families is often a strategy used, particularly when income is low or need special care is required.

As mentioned above, in Mexico, the support of older adults usually occurs via co-residence. If we add to this fact the inability of public institutions to absorb the needs of this growing population, we see that this cohabitation is employed as an informal support network. This usually goes in both directions: from the children to their parents and from the parents to their children. According to data from the 2010 Mexican census, 14.3% of households had at least one adult aged 65 years and over.

According to data from the Health and Aging Survey (SABE project)[1] about one of five older adults in Latin America changed residential settlements during the 5 years prior to the survey. Part of the results of this analysis of aged people is that they are more likely to live alone, but as their age increases the ratio declines. This has to do with the fact that an increase in age may also be an increase in physical limitations or dependency.

It is also the case that there is a link between the phase of the life cycle and changes in living arrangements for the elderly. In Mexico the percentage of co-residence of older adults with family is 19% (SABE project).

In Mexico demographic research on aging has examined the impact of these arrangements on the welfare of households and their members. It has been found that this phenomenon is not static but depends largely on the life cycle of older people, and the needs of the residents and the lifecycle of the children in household (Solis 2001). That is why the type of household in which the elderly reside depends on a shared decision between them and their family. There are also studies claiming that in the future the proportion of households with only one parent in the household should increase due to the reduction in the size of families (Ham et al. 2003). In Mexico there is an excess of single-person female households, and these are mainly older women. It is also noted that when older adults are financially able and/or own their property, they prefer to live independently. It is only when they need assistance do they choose co-residence.

Meanwhile, Montes de Oca (1999) has argued that the way in which the older population resides is important for the forms of social support required. These supports can be familial or institutional, and may be material, intangible or by services. Different forms are used to assist the individual who requires service, at different stages of their life course.

This family support provided can be from family members, who may or may not be residing with the elderly, as well as from neighbors or friends. In this sense Montes de Oca (1999) has distinguished support by two types: intra-household and extra-domestic. By definition, the elderly who live alone, i.e., in one-person households, do not have intra-domestic support. If they have any support (monetary, emotional, information or service) it must come from other homes. In general, social support refers to the individual belonging to a social network in which the bonds

[1] Project for population 60 years and over in seven cities of Latin America and the Caribbean.

may be reciprocal. The effectiveness of this support will depend on the situation that is granted, the individual and their particular needs (Ham 2010).

The family is the place of affection, of care, and of altruistic solidarity, but also the place of submission, subordination and conflict (Castro 2013). It is constantly changing, in the same way that their networks, their organization and their functions change, and it requires a tremendous capacity of adaptation for the preservation of solidarity among its members, which will be reflected in supporting older adults.

Hence, we consider it important to analyze not only the types of households in which older adults reside, but also the family relationships within them and the existence of living with relatives or others (Huenchuan y Guzmán 2007). However, one also needs to take into account that belonging to a family does not necessarily guarantee that the elderly will receive support from household members. In Mexico it has been found that family support is becoming more important to the extent that people have low income and/or do not have institutional support that ensures social security.

Financial support usually comes from the closer family, specially their children, when an elderly person does not have a job or pension income. This support is based on a cultural and historical tradition that allocates to the family this role. However, the support is subject to the economic possibilities of the family as well as to the quality of the relationship between them.

10.3 Data and Results

In the analyses we undertake in this chapter, we use microdata samples from the Population and Housing Census of 2010; these data provides information of the resident population in the country, and its main demographic and socioeconomic characteristics.

As we have shown earlier in Tables 10.1 and 10.2, the percentage of population aged 60 and over in 2000, for the country as a whole is about 9.0%, and in the State of Mexico it is about 8%; these percentages are expected to increase in the coming years (Fig. 10.1).

A common measure used to determine the degree of dependence of the elderly population to the young population is the aging index, defined as the ratio of the number of persons 60 years and over per 100 persons under 15 years of age. The ratio for Mexico in 2010 was 21.4, meaning that there were 21.4 old persons per 100 persons aged youth (CONAPO 2011). We show in Table 10.3 that for the State of Mexico the ratio is 26.1, and it is greater for women than for men.

Table 10.3 Ageing index. State of Mexico

Male	Female	Total
23.6	28.7	26.1

Source: Prepared with the 2010 Census microdata (INEGI)

Table 10.4 Dependency ratio of people aged 60 and over by sex. State of Mexico, 2010

Sex	Ratio
Male	11.8
Female	12.8
Total	12.3

Source: Prepared with the 2010 Census microdata (INEGI)

Table 10.5 Number of members in the household aged 60 years and over by sex, State of Mexico, 2010

Members	Male	Female	Total
1	11.8	32.8	44.6
2	20.8	9.7	30.5
3	6.5	6.8	13.3
4	2.9	2.9	5.8
5 and over	2.8	2.9	5.7

Source: Prepared with the 2010 Census microdata (INEGI)

Another measure of dependency is the total dependency ratio, i.e., the number of youth (persons aged 0–14) plus the number of elders (persons of age 60 and over), per 100 persons in the producing ages of 15–59. Note that the numerator includes both children and the elderly. This ratio may be disaggregated into a youth dependency ratio and an aged dependency ratio. We show in Table 10.4 that in 2010 the aged dependency ratio for the State of Mexico is 12.3. The ratio for all of Mexico is 9.1. Thus the dependence of elderly people requiring support and care is greater in the State of Mexico than nationwide.

We next look at household size. The average number of members per household, according to data from the 2010 Census, is 3.9 members per household for Mexico, and 4.1 members in the State of Mexico. In the Table 10.5 we show the percentage of households with elderly according to the size of the household. We show that elderly men tend to live in households with two members, while women tend to live in households with one member. We show in the table shows that the majority of old adults live alone, or with another member, probably the spouse. These results are somewhat unexpected given our discussions of elderly co-residing with other relatives.

The type of household in which older people live is an important matter to consider because it provides information about the potential support that the elderly might need or be provided. For example, 32.8% of women aged 60 and older do not have any family member living with them. The data in Table 10.6 shed some light on the living arrangements of the elderly in the State of Mexico.

The results for the State of Mexico show that the highest proportion of seniors living in family households live in extended households, representing 9.8%, followed in importance by those in nuclear households (households where the couple is living together). The data further indicate that elderly men are mostly in households where their spouses are present; this is less likely for elderly women, probably due to higher male mortality.

Table 10.6 Population 60 years and over by type of household in which they reside, by sex, State of Mexico, 2010 (%)

Sex\type of household	Nuclear	Expanded	Compound	Living alone	Co-resident	Total
Male	29.7	11.8	0.4	3.0	0.1	45.7
Female	36.1	13.5	0.3	3.4	0.1	54.3
Total	65.8	25.3	0.7	6.4	0.2	100

Source: Prepared with the 2010 Census microdata (INEGI)

Table 10.7 Percentage of population 60 years and over as head of household by sex: State of Mexico, 2010

Sex	Percentage
Male	12.7
Female	6.9
Total	19.5

Source: Prepared with the 2010 Census microdata (INEGI)

We show in Table 10.7 that the number of persons aged 60 and over make up 19.5% of all heads of household in the state of Mexico. Elderly men are almost twice as likely to be heads of household than are elderly women.

Finally, an indicator of the degree of social interaction, as well as the existence of support networks, of people 60 years and over, is their marital status. We aggregate the married elderly—civil, religious and both, or in consensual union—as one category, and group those who are divorced, separated or widowed in a second category as ever in a union.

We show in Fig. 10.3 that male elderly are most likely to live in a union, with far fewer formerly in a union, or being single. In contrast, slightly more elder females have been in a union in the past than are currently in a union, with even fewer elderly women being single than are elderly men.

We also show in Fig. 10.3 that elderly women are more likely than their male counterparts to not have a spouse (mostly due to its death) and, thus, represent a potential need for social support more so than male elderly.

We show in Table 10.8 that almost all elderly women in the State of Mexico have at least one child, and that the average number of surviving children per woman is 5.2 children. Under the assumption that there is an implied obligation to help parents when they need help, the elderly population might have support from their children when needed.

10.4 Discussion

We have shown in this chapter that the elderly in the State of Mexico represent a substantial, and rapidly growing, proportion of the total population. In the coming years, the elderly will comprise between 20% and 25% of the total population, growing much larger by 2050. The aging of the population in the State of Mexico,

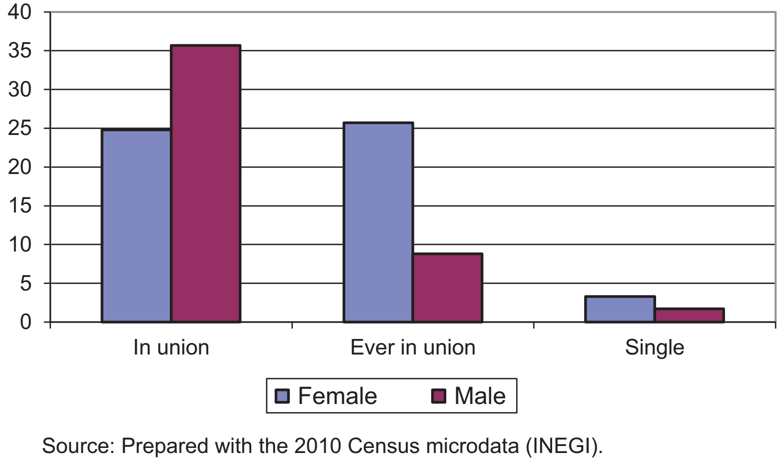

Fig. 10.3 Population 60 years and over by marital status and sex (%). State of Mexico, 2010. (Source: Prepared with the 2010 Census microdata (INEGI))

Table 10.8 Percentage of children for women aged 60 years and over, women by urban/rural location: State of Mexico, 2010

Number of children	Rural	Urban	Total
0	0.7	0.4	0.4
1	4.7	7.1	6.8
2	5.8	11.6	10.9
3	7.8	15	14.1
4	9.5	14.3	13.7
5	10.6	13.8	13.4
6	12.5	11.4	11.5
7	12.8	8.9	9.4
8	11.8	6.6	7.2
9	9.8	4.7	5.3
10 y más	14.1	6.1	7.1
Total	100	99.9	99.9

Source: Prepared with the 2010 Census micro data (INEGI 2010)

as in all of Mexico, will increase the burden that young people have with respect to the elderly. This needs to be taken into account when planning policies and programs. This is one important reason why we need to know the basic characteristics of the elderly to help understand the role of both family and State to maintain the quality of life of the aged.

Our results suggest that much of the elderly population in Mexico has potential support from their families, given a fairly high number of surviving children for this generation. However, to determine whether this support is given in real terms may only be assessed through a specific survey on the subject or by undertaking more detailed quantitative and qualitative work that would allow us to analyze this issue in greater depth than is possible with census data.

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Chapter 11
Intimate Homicide Mortality in Alaska

Donna Shai

11.1 Introduction

Even though Alaska has one of the smaller populations of all the states of the U.S., it is an interesting case for the study of intimate homicides. Although geographically separate from the rest of the states, and having large urban and rural areas, it is not surprising that Alaska has some unique cultural aspects that affect the relationships between men and women. One is the persistent notion of rugged individualism that could well be influencing domestic violence (Hogan and Pursell 2008). There is a widespread use of weapons in the state. Moreover, Alaska's employment situation in the past provided ample jobs for men, such as in the pipelines, mining and construction industries. But currently, there are fewer opportunities in these areas. At the same time, there are more opportunities for women in education and government work. Nevertheless, research has shown that women in Alaska earn 77 cents for each dollar earned by men working full time, year-round (Haymes and Spielberger 2012).

Alaska has a diverse population of various racial groups including whites, a large indigenous population of Alaskan Natives, including both Eskimos and American Indians; and smaller populations of Asians and Blacks. There are nine military

I thank Alfred Andrew Fry, Science Librarian at the Falvey Library, Villanova University, for generous help in preparing the cases for search at the Alaska Courthouse. I also thank W. Clinton "Buck" Sterling, Public Services Librarian at the Law Library of the Alaska Court System, for helping me navigate the on-line resources of the Court. I am also grateful to the staff of the Court for providing me with files on the cases from Anchorage and for offering valuable suggestions. I also thank Nancy Olsen, Deputy Clerk of the Palmer Courthouse, for court trial records for the three cases tried in Palmer.

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bases located in the state. Policing is thin in some rural areas. Finally, and importantly, alcohol and drug consumption are high and are frequently reported as the causes of intimate homicides. Research has noted the role of alcohol consumption is a major contributor to intimate partner violence; see especially the studies reported by the World Health Organization (2006).

The state of Alaska has consistently been reported to be one of the most dangerous locations for women. Alaska was ranked second in the United States by the Violence Policy Center with respect to females murdered by males in both 2007 and in 2011 (Violence Policy Center 2014). Moreover, *Forbes* has cited Alaska's two largest cities, Fairbanks and Anchorage, as the second and third most dangerous cities in the U.S. for women (Casserly 2012). Furthermore, a Federal panel recently condemned law enforcement in Alaska villages, especially among Alaska Natives, as the worst for any Native American group in the United States, citing insufficient law enforcement presence and serious problems in public safety, including homicide and alcohol abuse (Mauer 2013).

This research reported in this chapter deals with intimate homicide, that is, "a homicide by a current or former legal spouse, common-law spouse, boyfriend or girlfriend" (Breitman et al. 2004:321). I undertake a qualitative analysis of twelve intimate homicides, selected from the 23 such homicides reported in Alaska between 2007 and 2012.

11.2 Data and Methods

In my qualitative study of homicides affecting women and children, I used several different data sets. First, I used the *FBI Uniform Crime Reports*, Supplementary Homicide Reports for Alaska (SHR) for the years from 2007 to 2012. SHR is an important source of data on homicides and includes breakouts by race, among other variables. Since not all homicides are covered by the SHR and, moreover, since the SHR is usually available about 2 years after the occurrence of the events, I reviewed the news stories in a number of newspapers, including *The Anchorage Daily News, Fairbanks Daily News-Miner, The Alaska Dispatch, and The Nome Nugget*. In addition, during May of 2014, I searched the files of all the intimate homicides at the Alaska Courthouse in Anchorage and used the Courthouse electronic files to search the criminal records of the offenders. For three cases that occurred in the Palmer jurisdiction (see below), the Deputy Clerk of the Courthouse in Palmer provided me with copies of the court documents including files and trial notes associated with those cases. In addition, I used data and information from various websites, including JuneauEmpire.com, KTUU (Channel 2, Anchorage), Google, and Lexus-Nexus Academic.

I discuss in the next section some of the demographic aspects of the twelve cases I analyze in this chapter. I next review several theories that provide perspectives for the analysis of intimate homicides. All names of persons involved in the twelve cases that I analyze in this chapter have been changed to protect their privacy.

11.3 Demographic Features of the Subjects

The various demographic features of the subjects and their respective homicide cases include the location of the homicide in Alaska, the gender and ages of the persons involved, and the ethnicity of the victims. Of the twenty-three cases of intimate homicides in Alaska that were reported over the period of 2007–2012, twelve occurred in the Anchorage district (south central Alaska), three in Palmer (northeast of Anchorage), three in Bethel (west of Anchorage), three in Fairbanks and two in Nome (the map below shows the locations of these areas). These twelve cases are the ones I analyze in my qualitative study in this chapter of intimate homicides in Alaska.

Source: http://www.smart-traveler.info/map_of_ak.html

Research has shown that an age differential between closely associated persons is a key risk factor for intimate partner homicide (Breitman et al. 2004). Age-discrepant couples are at an increased homicide risk if the man is at least 16 years older than the woman, or if the woman is at least 10 years older than the man (Breitman et al. 2004: 335–340). The factors relevant for persons who are of different ages include differential physical strength and vulnerability, stresses arising from age differences, sexual jealousy, and the presence of stepchildren. Indeed, of the 23 intimate homicides that occurred in Alaska in the years covered by my analysis, five have age discrepancies: Debra Cliffson, 40, was murdered by her husband, Lew, 64. Carl Ott, 63, was stabbed to death by Betsy Mackey, 43. Mandy Parsons, 43, was murdered by her husband, Joe, 68. Carol Bloch, 44, was beaten to death by her husband, Bill, 63. And Bob Mitchell, 40, was killed by his wife, Nancy, 24, after he had severely abused her.

The average age of the six male and 16 female decedents was 36. Of the female decedents, one was killed by a female intimate partner, the remainder by males. The largest race group for victims was whites at 11, followed by Native Alaskans at 9, Asians 2, and Blacks 1. The majority of homicides were between persons of the same race.

11.4 Three Theories of Intimate Homicide

I turn now to a discussion of the three main theories of intimate homicide that provide perspectives for the qualitative analysis of my data. First, general strain theory argues that men and women who kill an intimate partner experience different emotions in the period leading up to the homicide. According to Eriksson and Mazerolle (2013), men who feel a loss of control are likely to suspect infidelity on the part of their partners, leading to jealousy and rage. On the other hand, researchers have argued that women who kill their partners feel fear and desperation stemming from their experiences of domestic violence. It is maintained that women kill in self-defense and report that they experienced anxiety. General strain theory argues that men and women experience different strains. Men often foresee the loss of their partners and take steps to prevent their emancipation, especially if the partners are perceived as leaving them for other relationships. Similarly, with regard to child murder by the father, the underlying motive may be one of retaliation by punishing the mother (Eriksson and Mazerolle 2013). Male perpetrators with high negative emotionality have been shown to be less likely to think about the consequences to themselves; instead, they tend to be more preoccupied with their sense of injustice and loss of control. On the other hand, women are more likely to take a self-defense perspective. They may experience a loss of identity with restricted freedom. It has been shown for instance that women tend to kill more out of fear and to use violence for personal survival.

Given these differences in reacting to strains that could lead to homicide, I argue that it is important that there be gender-appropriate support services for men and women who may be at risk of carrying out violent acts. Eriksson and Mazerolle (2013) have noted that gender-specific coping mechanisms are needed to counter attitudes such as male entitlement and control. These mechanisms need to be in place to reduce the likelihood of intimate partner homicide.

Second, a theory that considers differences between male and female perpetrators is known as male sexual proprietariness and self-defense theory. It deals especially with familicide, that is, situations where a man kills his wife and child (or children). The theory addresses the fact that a woman's desire to terminate a relationship, or the man's inability to control her, often precipitates femicides (Serran and Firestone 2004). In the case of women using homicide in self-defense, researchers have noted that women who killed men had often been first beaten by them; the women claimed they were trying to stop the violence, and to protect themselves and their children. In such cases, the prevention would lie in trying to reduce the interpersonal violence and provide the partners with coping mechanisms, along with safe houses and laws against stalking.

Third, another theory examines femicide from a feminist perspective (Taylor and Jasinski 2011). This research cites the fact that women are at a much higher risk of being killed by an intimate partner than are men. It uses a patriarchal focus and maintains that the social institutions of marriage and the family "promote, maintain, and even support men's use of physical force against women" (Taylor and Jasinski 2011: 342). It is argued that violence can be a tool to keep women subordinate and thereby to maintain control over them. This research shows that women do not abuse their partners to the same extent as do men, and that men cause much more injury to women than women cause injury to men.

A frequent argument is that men usually kill their partners at the conclusion of a period of violence, whereas women usually kill out of self-defense. It has been shown that women do not abuse at rates equal to men, and that women are at greater risk of homicides from their intimates than are males, and are more likely to be killed by an intimate partner than by any other type of perpetrator. It has been shown that as women gain more equal status with men, financially and\or occupationally, the risk of being killed increases, especially if the advancements are seen as threats to men's power and privilege (Atkinson et al. 2005). In fact, some men may feel that women's increased economic independence may threaten their power over women.

Most studies of intimate homicide have been based on urban populations. Considerably less attention has focused on homicides taking place in rural areas. In rural situations, the abuse of women may actually increase, through the use of intimate terrorism, an important concept which I now discuss.

Intimate terrorism is a concept rather than a theory and involves the use of multiple forms of control over a victim and over time (Johnson 2008). It can involve economic abuse (controlling money), controlling the children, and isolating the woman; it may involve emotional abuse by humiliating, abusing and demeaning the woman. If she does not obey, the terrorist may threaten to hit, beat or kill her and her children (Johnson 2008: 9). The terrorist may also be extremely demanding (Bancroft 2002). It has been shown that the male terrorist often gets enjoyment out of causing fear and pain; if the woman leaves him, he may stalk her or threaten her for a long time (Bancroft 2002). It has been argued that the terrorist is more sadistic than other abusive men, likely stemming from having been abused as a child. Johnson (2008) has argued that the perpetrator of intimate terrorism uses terror to control his victim and uses violence to prevent the victim from controlling him.

I now use the above theories as perspectives for analyzing qualitatively twelve cases of intimate homicide mortality from Alaska.[1]

[1] This research report does not include a well-publicized case in 2011 of a Fort Wainwright soldier sentenced to life by a military panel for killing his wife by strangulation. Since it occurred on a

11.5 Results: Analyses of Twelve Cases in Alaska

In the analyses reported in this section, I use Johnson's (2008, 5) definition of intimate terrorism as that situation where "the perpetrator uses violence in the service of general control over his or her partner; the partner does not." Each of the twelve cases is headlined with the name of the decedent.

1. **Barbara Simon.** Barbara Simon, 43, was murdered by her boyfriend, Al Firestone, 47. The evening before she had been visiting a friend, Bill, and another man she knew. According to her family, she was having problems with Al Firestone, and that was why she went to Bill's house. He advised her to leave Firestone, who at the time was walking around outside the house with a beer. Firestone accused Bill of having an affair with Barbara. Bill told him to come back when he was sober, and he told Barbara to get a restraining order against him.

On the following morning, Firestone charged into the house, but was forced to leave. He returned and began arguing with Barbara, who told him their relationship was over. Firestone then started to leave but grabbed a knife from the kitchen and stabbed Barbara seven or eight times, while straddling her body. He then beat her with a sledgehammer and left it across her chest. He later went to the cabin manager and told him that he had killed his wife, Barbara, and needed to go to jail. He asked another man to just shoot him for the same reason.

Firestone had previously been charged for assaulting Barbara, and she had applied for a domestic violence protective order in Anchorage. He was arrested and State Troopers noted that he had a strong odor of alcohol. There were prior cases against him in connection with other women. Female witnesses said that when he was drunk he was always angry and violent with women, beating and punching them, giving them black eyes or pulling their hair, and accusing them of infidelity. When he was sober he was not offensive. For Barbara's death he was charged in Palmer Superior Court with 1st and 2nd degree murder.

Al Firestone is a prime example of an intimate terrorist who terrifies his victim so much that she is afraid to get away from him. Whenever Barbara would try to break off, Firestone would fly into a rage. His drinking and subsequent beatings made the situation even worse. Others described him as a very jealous and controlling person. He had a long rap sheet for assault cases, drunken driving, disorderly conduct and criminal mischief. This was a case where Barbara would only have been saved had she been able to get far enough out of the region to escape from Firestone.

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military base, it was tried in a military court and did not appear in Alaska Court records or in Supplementary Homicide Reports. My research in this chapter also does not include the case of a soldier, returned from Afghanistan in 2012, who shot his wife, baby and then himself. He survived, although gravely wounded.

2. **Joyce Phillips.** Joyce Phillips, 42, a business consultant before her death, was beaten to death by her boyfriend**,** Vince Todd, 47. Todd had a long history of violence starting at age 16 when he beat an Air Force officer with a tire iron and slashed his throat. He also had a lengthy record of assaulting women. At his trial for Joyce's murder, many women with whom Todd had had relationships testified to his violence. He would start out being kind and considerate, and later turned abusive. He introduced Carrie, a woman he met in Tucson, to crack cocaine, took out loans in her name and used all the money in her bank account to buy drugs. While living in her home he became violent, throwing her against the wall and kicking her. He hit her at the back of her head so the injuries would not be noticed. He tried to strangle her several times. When she tried to get away, he threatened to plant drugs in the house. She filed a domestic violence charge but never took out a restraining order against him. He told her he would burn down the house or have her gang-raped if she called the police.

Todd's ex-wife, Megan, testified that at first he was charming and attentive. Later he turned jealous and possessive. She became fearful of leaving him because he threatened to beat her severely. He threw her around and pulled out her hair. He destroyed all the furniture in her house, slashing the upholstery and stomping on the electronics. He repeatedly told her he hated her, called her vile names, and stated that he was going to kill her. He went to jail for his offenses, and eventually they divorced.

Later, he met and established a relationship with Joyce Phillips. Although many people noted the control he had over her and feared for her safety and tried to intervene, she was not able to get away from him. Todd beat her to death, and she died from multiple injuries to the brain and a contusion to her heart. She had a battered head, swollen face, broken nose, broken ribs, a bruised heart, black eyes, an ear nearly torn off, and bruises from head to toe. Todd drove with her dead body in his car until he was stopped by Alaska State Troopers. He was then charged with 1st degree and 2nd degree murder. He was sentenced to 99 years with no discretionary parole.

The jury unanimously found Todd guilty of 1st degree murder. At his trial, he presented numerous stories to cover up his violence, including one that she was beaten and killed by drug dealers, and another that her injuries were from a plane crash. His alcoholism, while not an excuse, aggravated a violent disposition. He also is an excellent example of an intimate terrorist, owing to his repeated quest to control the women in his life through brutality.

3. **Jean Davis.** Jean Davis, 43, was bludgeoned to death by her boyfriend, Peter William Reading, 47. He had accused her of cheating on him in an alcohol-fueled rage. She was stabbed and severely beaten. Reading had attacked her numerous times previously, and had been jailed a number of times because of these violations. Jean Davis was mother to a number of children and was trying to leave Reading at the time to return to her village.

Reading had been charged previously with a number of assaults, drunk driving, disorderly conduct, and criminal mischief. Despite pleas from family members to leave him, Jean was too afraid to do so. He often took her to locations where she was isolated and away from anyone who could help her; she feared for her life. Reading referred to Jean as his wife, but others reported that he was not formally married to her. A jury convicted him of 1st degree murder in 2010.

While alcohol cannot be overlooked in this incident, the preoccupations of the boyfriend suggest control, violence from a presumed "ownership" over Jean's activities, blaming and intimidation, and beating her in front of her children. As Johnson has argued, a violent "partner will do anything to maintain control of the relationship" (Johnson 2008: 9), and the effect of alcohol is one possible factor.

4. **Mary Beth Samuels.** Mary Beth Samuels was 31 and had two young children. She grew up in Alaska. After getting divorced, she worked at a bar and at fast-food restaurants. Her boyfriend, Harry Maynard, 35, controlling and jealous, confronted men at the various places she worked until he was banned from these places for harassing the customers. He strangled Mary Beth in a jealous rage. Her bound body was found partially buried near a highway. Her friends and coworkers reported that she was afraid of Maynard and had been trying for some time to end the relationship. Maynard was charged with first degree murder and evidence tampering. He was sentenced for up to 75 years.

This case is an excellent example of the problem of the jealous and controlling partner whose anger fueled his tyrannical behavior. The situation of harassing a partner at the workplace is indicative of ill intent, especially in this case where it was known that Maynard had a history of violence with other women. Part of the difficulty in escaping from a pursuer in Alaska is that even though Alaska is a large state, its population is one of the smallest in the U.S. If a woman ordinarily makes her living in bars or restaurants, it is not difficult for a determined person to find her. Having a child living in the home who was not the abusive partner's biological child, as was the case here, may also have increased the risk of femicide (Campbell et al. 2008).

5. **Jeannette Ordman.** After a visit to Anchorage, Jeannette Ordman, 27, returned to her rural village in Hooper Bay, a settlement on the West coast of Alaska that is inhabited almost entirely by Alaskan Natives. At home, she and her boyfriend, Gerald, 33, drank "home brew," an intoxicating mix of yeast, sugar and juice. Since commercial alcohol is not easily available in some rural areas of Alaska, the practice of making home brew has proliferated. The two daughters of Jeanette and Gerald, ages nine and two, were also living at home with them. Under the influence of the drink, Gerald accused Jeannette of cheating on him when she was in Anchorage. He threw her around the house, punched her in the face and chest, kicked her, pulled out her hair, and stomped on her stomach; all of this occurred in front of their children. The next morning the girls found Jeannette dead, covered with bruises, and with clumps of her hair on the floor. Gerald reported the killing to the public safety officer, who called a state trooper. He was

charged with 1st degree murder, and the girls were sent to live with their grandparents.

This is a case of intimate terrorism created or exacerbated by an intoxicating substance (home brew made with yeast). Because alcohol has caused so many deadly incidents in native communities, some have banned it. In its absence, some residents have responded by making home brew from common ingredients. While there have been attempts to prevent yeast from being sold in some locations, it is an enduring problem, leading to tragedies like the one described here. It is unlikely that the accusations would have been made if the husband had been sober. After all, Anchorage is a major shopping and cultural center and has a large population of Alaskan Natives. The violence that killed Jeannette probably would not have occurred. Natives from some of the more remote areas of Alaska regularly travel to Anchorage to visit family and friends, to enjoy movies and theater, to stock up on supplies, and to enjoy the metropolitan atmosphere. It is possible that the trip brought out latent fears on the part of the husband. The other possibility is that extreme jealousy brought out by intoxication set off an irrational rage in an otherwise controlled person.

6. **Dana Machado.** Dana Machado, 58, was shot in the head by her roommate, Henrietta Hynes, 66. Hynes used a gun that had been bought for home protection. She was angry, ostensibly because Dana did not help her to the bathroom. However, earlier, Dana had stated her intention to return to Hawaii, and Hynes was upset about this. Alcohol was also a likely factor in the murder. Court files indicated that Hynes had been struggling with alcoholism and acknowledged that on the day of the shooting she had been drinking. While the law does not allow alcohol to be an excuse for murder, it was likely that the medications she was taking interacted with the alcohol. During the day of the shooting, she had consumed rum, beer and pills to help her stop drinking alcohol and possibly taking other medications. On the previous day, Hynes had made threats with a knife. The two women had been together for 20 years, having met 10 years earlier when they were nurses in Anchorage. In the Anchorage Superior Court in November of 2012, the judge sentenced Hynes to 25 years in prison, taking into consideration that prior to this event she had shown lawful behavior.

This is an unusual case in that it involves a murder between two lesbians, a rare event in Alaska and in general (Mize and Shackelford 2008). It seems likely that the murder was touched off by Dana mentioning her intention to leave Hynes to return to Hawaii, after living with her for 20 years. While a partner threatening to leave can be a source of strain on a relationship (Eriksson and Mazerolle 2013), in this case it was fueled by alcohol mixed with medications. Usually, as people age, they are likely to be taking a variety of medications, and Hynes was no exception. However, mixing alcohol with prescription drugs can be very dangerous. The easy access to a firearm, purchased for protection from an outsider, contributed to the shooting by Hynes of her partner in the head.

7. **Mary Gomez.** Not long after Sam Gomez, 24, returned home from serving in Afghanistan, his wife, Mary Gomez, 31, found bruises on their daughter, aged two. She contacted Child Services to take temporary custody of the toddler. Shortly thereafter, Sam Gomez called Child Services and said that if they did not return the daughter he was come and shoot everyone there with an AK-47 rifle; he stated that he was an angry person with a bad temper. About 20 minutes later, he called police to say that he had shot his wife. When asked why he shot her, he answered that their daughter had been taken away. It is not clear whether he actually abused the child. Officers on the scene said the residence contained many firearms including an AK-47 rifle. Later, in court, Gomez maintained that Mary had shot herself.

Although stress factors should not be used to excuse Sam's actions, members of the military are subject to several sources of strain. Enlisted personnel are often young, have low paying jobs, and are subject to frequent separations from the family. In this case, Mary Gomez believed that on the return of Sam Gomez from overseas, their 2 year old child should be placed with protective services. There was evidence that the child had suffered bruises from the father. His threats to kill everyone at child protective services with an AK-47 rifle unless they turned over his daughter are an indication of why Mary felt that the child should not be in the same home with him. His response was to kill Mary by shooting her in the head.

Many other options were open to him in both the conflict with his wife and in the arrangements for the child, since he had not lost custody of the child. In June, 2014, a jury trial in Anchorage found Gomez guilty of shooting and killing his wife, Mary, and convicted him of 1st degree and 2nd degree murder. He was also convicted of making terroristic threats at the Office of Child Services. He was sentenced to up to 99 years in prison.

8. **Carol Bloch.** Carol Bloch, 46, was murdered by her husband Bill Bloch, 63. He told police that he had beaten his wife with a baseball bat, striking her repeatedly in the head before delivering the fatal blow. He left her on the floor in the bathroom, unconscious and bleeding. He then left her body in the Matanuska Valley north of Anchorage. He claimed to have killed her because she had threatened to expose his criminal enterprises, including stealing hundreds of thousands of dollars from a mentally disabled man whom he had counseled. Bill Bloch had had the patient, Keith Ron, sign over to him the power of attorney so he could control the sizable trust fund Keith's father had left him. Bloch then spent the money lavishly on himself. He continued to blame his wife for her death. He was sentenced for theft in the 1st degree and murder in the 2nd degree for attempts to defraud, theft, forgery, and murder with extreme indifference. He had had one prior felony.

In this case, Bill Bloch was convicted by a jury in Anchorage of 2nd degree murder for carrying out multiple crimes with indifference to human life or the welfare of his patient in counseling. He had killed his wife basically to avoid having his crimes exposed to the authorities.

9. **Doris Baymon.** In December, 2013, Doris Baymon called 911 to report that her boyfriend, Kevin Cane, had been shot. She reported that they had been drinking and playing with guns when she shot him in the head. When the police arrived at their home, they arrested her. She had a strong odor of alcohol, and there were vodka bottles and glasses on the coffee table. Witnesses in the apartment building stated Cane was yelling at Baymon, telling her she needed to leave the apartment. Baymon observed that she and Cane were arguing because she had discovered that he was dating other women. A drunk driving arrest was her only previous record.

This case illustrates the dangers of drinking and playing with guns, particularly when arguments arise. As I have noted in some of the other cases analyzed above, the subject of "infidelity," which will also be addressed in the next case, is a topic likely to arouse anger, and under these circumstances often leads to deadly violence.

10. **Charlene Carlson Lee.** In 2012, Charlene Carlson Lee, 47, was shot by her boyfriend, George Mackey, 36, while in bed after the two had been drinking and arguing about his being with other women. (There is a discrepancy in the data I examined about this case with respect to the age of Charlene. In most documents, her age appears as 47, but in a few documents, her age is stated as 42.) Mackey claimed that he was angry with her because she had had an abortion. Her family maintains that she had not been pregnant, and had an adult daughter. After calling the police, he confessed to having taken Ativan (a benzodiazepine used to treat anxiety disorders or anxiety associated with depression) and drinking alcohol. He had been diagnosed with depression at the age of 12, and later he was diagnosed with bipolar and post-traumatic stress disorder following childhood abuse. He described himself as an unemployed computer professional. He used and abused drugs over a long period of time. When asked why he shot Charlene he said it was domestic violence, and that he should be punished. He had been charged with domestic violence several times in another state. Mackey was convicted by a jury in 2013.

George Mackey had a history of domestic violence. Also, he frequently mixed drugs with alcohol. He initially blamed the killing on his girlfriend Charlene, but later recanted. The fact that he was unemployed may have added strain to the situation, especially if it led to what criminologists call "compensatory violence" (Melzer 2002; Atkinson et al. 2005), namely, the situation in which a man who is unemployed will display violence in front of a female intimate who is employed, or in front of children, to make up for a loss of status. In custody, Mackey confessed to anger management issues and substance dependency. The age discrepancy may have added to the tension in the relationship.

11. **Debra Cliffson.** Lew Cliffson, 64, shot his wife Debra Cliffson, 40, when she asked for a divorce. This was a case in which the husband was much older than his wife. He had been sick for some time and had become increasingly suspicious about Debra's fidelity. Their three children heard the parents arguing in

the bathroom. One daughter heard the mother say "Don't push me," and then she heard two shots. She found her mother bleeding and her father holding a gun. Officers found a 5-shot 38 caliber revolver with two spent casings and five live rounds in the cylinder. Lew Cliffson had no known criminal convictions in Alaska. When officers asked Debra who shot her she said "My husband, we are getting a divorce." She died 2 days later. He was convicted in October, 2013.

This case involved an older husband in a conflict with a younger wife who was asking for a divorce. At a time when he was dealing with some other family issues, and suspicious of his wife's fidelity, he shot her in the bathroom. This is a case of sexual jealousy and control; it involved someone who had not had previous encounters with the law, and who was taking revenge for the threatened departure of his intimate. The murder may have been aggravated by his illness and the age discrepancy between them.

12. **Nancy Mitchell**. Nancy Mitchell, 24, had been repeatedly abused, raped and imprisoned by her husband, Bob Mitchell, 40. According to court testimony, he had called her insulting names and had actually raped her in front of their children, choked her until she became unconscious, and tortured her. He hit her in the kidneys, and kicked her in the stomach and back. He locked her in a bathroom and would not let her out despite her pleading, and he also cut off chunks of her hair. He threatened her with a machete when she obtained a restraining order against him. She sought refuge in an unmarked shelter for women in Anchorage, but he found her. He was enraged when she wanted a divorce, pointed a gun to her chest, and threw her out of the house with no clothes on. On numerous occasions, he threatened to kill her and the children. She felt that as an ex-policeman, he would find her no matter where she went. He became convinced that she was cheating on him with a coworker, and, despite her denials, went to her place of employment, trying to get both of them fired. She was suspended temporarily because of the harassment. He threatened to kill her, but she was too scared to leave with the children. He devised a torture in which he hung her from the ceiling, beat her with a belt, and tried to set her on fire, demanding the truth about her cheating on him. He asked her how she wanted to die. Believing that he was going to kill her and the children, and his threat to find her anywhere and kill her, she grabbed his gun while he was sleeping and shot him, killing him. At the first trial, she was charged with 2nd degree murder, manslaughter, and criminally negligent homicide in Palmer. Later, in 2013, she was retried and found not guilty on all charges.

This case is that of an extremely battered woman driven to kill in order to preserve her life and the lives of her three children. According to the theoretical discussions in this chapter, Bob Mitchell was clearly an intimate terrorist, using harsh control and physical violence on his wife. It seems that if she had not taken some actions, she might not have survived the ordeal. The jury evidently took her perspective. General strain theory (Eriksson and Mazerolle 2013) seems to be especially relevant for the analysis of the Mitchell case. Bob Mitchell was preoccupied with the possibility that she Nancy Mitchell been unfaithful to him, despite her denials, and her actions appear to stem from fear and the survival of the children and herself.

11.6 Discussion and Conclusion

In this chapter I have presented a qualitative analysis of selected intimate homicides in Alaska. I showed that while most of the homicides were perpetrated by men, almost a quarter of them were perpetrated by women. The motives behind the men's attacks in some cases were a sense of maintaining a hold on the woman, using great force, despite the women's objections. The forces were so great that they often led to homicides. The women's motives ranged from self-defense to anger over infidelity. In both cases, couples could have profited from counseling, especially in order to end relationships without violence and tragedy. It would be efficacious to train counselors to help partners to peaceful relationships or to assist them in parting without violence. Agencies, including the military, should take special steps to prevent "multiple family homicides" (see Liem and Reichelmann 2014) by carefully monitoring the reentry of service men and women to civilian family life.

Since women seem to be more at risk than are men, efforts should be made to help them deal with stress in dating and in marriage. There could be "hot lines" established with information distributed in doctors' offices, schools, workplaces and government offices.

In the analyses I conducted in this chapter, age discrepancy seemed to be a risk factor in a number of cases. While people need to be free to marry persons of their choosing, when one partner is significantly older than the other, care should be taken to get help when problems arise.

The events that drove the homicides analyzed in this chapter were harassment, arguments about children, getting together after a separation, fears of infidelity and/or relationship break up, losing control over a partner, stalking, interfering with partner's livelihood, discussing other men or other women in one's life, and announcing a separation or parting. The aggravating factors included threats, abuse, alcohol, home brew, breaking up, infidelity, guns, illicit drug use or legal drugs mixed with alcohol, moving out, employment or unemployment, asking for a divorce, and announcing a move without the partner to another state. While these factors can be threatening, especially to a possessive and/or insecure person, there are many paths for dealing with stress. Alternatives available include the separation, if it would help all the parties.

Other prevention strategies include avoiding relationships with abusive persons by slowing down intimate relationships. As Adams (2007) has pointed out, it is difficult to recognize abusive men prior to the offense because these men are not necessarily mentally ill, criminal, or uneducated. Since many perpetrators of intimate homicide, both male and female, came from backgrounds of childhood abuse, it would be helpful to try to reduce that destructive child socialization technique to prevent future intimate homicides. It would also be helpful to socialize children into nonviolence. Public health messages could be introduced on the radio and on television and the internet to prevent intimate violence. Schools could be urged to include anti-violence as part of education, especially in the rural areas of Alaska. Since Alaska has become a destination for many immigrants from different counties, it would be helpful to include avoidance of violence, especially toward women, as part of the citizenship program. Since the rural areas of Alaska are thinly policed, it would help to have State Troopers on the lookout for potentially dangerous situations so that preventative steps could be taken.

Alcohol and drug use were found to be key factors in many of the homicides analyzed in this chapter. Programs to reduce or eliminate alcohol and/or drug use such as those in Alcoholics Anonymous could be introduced in many areas to talk about violence under substance influence. In at least one of the cases discussed here, medically prescribed drugs were mixed with alcohol, leading to a homicide of a partner. Doctors and pharmacists should make a concerted effort to emphasize the dangers of using these medications while drinking alcohol.

Education and higher education are strong counter-influences to committing intimate homicide. Providing low-cost courses to raise the educational levels of individuals would help, especially if the persons ended up becoming gainfully employed. On-line courses may be a less expensive alternative to those who cannot afford to attend a university.

Many of the perpetrators discussed in this chapter admitted to problems in anger management. The military, which deals mainly with a younger population, should provide counseling, particularly when male members are returning after tours of duty abroad. Counseling to control tempers and frustrations is essential and in several of the cases discussed, talking to a counselor might have prevented the homicides. In cases of antagonism between returning military personnel and their spouses, discussing alternatives to violence such as leaving the other person, temporarily or permanently, having both partners involved in counseling to work out differences, would be most beneficial. These may require more training of persons qualified to counsel in these situations.

Another issue that emerged from these cases was the danger of "playing with guns." While carrying or possessing guns is common in Alaska, guns need not be present in situations that typically are not dangerous such as when socializing with friends or romantic partners. Guns should be safely stored when not in legitimate use.

In an unusually dangerous case, it may be prudent to remove the targeted partner out of the area. Since Alaska has a small population, moving to another part of the state may not be sufficient or practical. Some alternatives would be for the person in danger to leave the state either to join family in the lower 48 or simply to avoid the dangerous person. In some cases, it is sufficient to pass the word that one is leaving Alaska but not actually doing it, to get a pursuer off one's trail. This can be reciprocal in that women who have been stalked in the other states sometimes come to Alaska to get away from a pursuer. While returning to one's place of origin might not be enough to deter a determined individual, a city like New York would be an ideal place to find refuge.

Persons who have familiarity with violence should be trained in counseling others. Possible victims should be taught to negotiate leaving a relationship for other partners slowly and carefully. They should be instructed to deal with the threatened suicide of a partner, or with the possibility of increased battering. Physicians and other health care professionals should be on the lookout for injuries that appear to be inflicted by another person. Safe houses should be established for temporary refuge.

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Chapter 12
Cognitive Decline Among the Elderly: A Comparative Analysis of Mexicans in Mexico and in the United States

Silvia Mejía Arango, Joachim Singelmann, and Rogelio Sáenz

12.1 Introduction

Aging is typically characterized by progressive cognitive decline. With this decline comes an increased risk of dementia, making Alzheimer and other forms of dementia important public policy issues in aging societies. According to the world report for Alzheimer's disease and other forms of dementia (Prince et al. 2015), there are approximately 47 million persons with dementia in the world, with 58% of them living in low- and middle-income countries. Poverty conditions, low education and reduced access to health care are some of the sociodemographic characteristics associated with the prevalence rate of dementia (6%) in Mexico (Mejía Arango and Gutierrez 2011). Given the rapid growth and aging of the Mexican American population the number of elders with dementia is anticipated to grow at an alarming rate. The Sacramento Area Latino Study on Aging (SALSA) reported an overall prevalence of 4.8% in Mexican Americans aged 60 years and older and an exponential growth with age that reached 37.2% among individuals aged 80 and older (Haan et al. 2003).

But there is considerable heterogeneity in individual trajectories: whereas some persons decline rapidly, others exhibit slower decline, and still others remain fairly stable in their cognitive ability. This heterogeneity has been found to be associated with health characteristics of individuals as well as socioeconomic and demographic conditions. The purpose of this chapter is a comparative longitudinal analysis of cognitive impairment of the elderly in Mexico and older Mexican Americans in the United States. We ask two main questions: (1) what are the similarities and

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differences between Mexicans in Mexico and Mexicans in the United States in the factors that influence cognitive impairment? and (2) are the sex differentials in the factors predicting cognitive impairment that have been found in Mexico similar or different for Mexican Americans? The answers to those questions will help us to understand the societal context of the factors associated with cognitive impairment. It also addresses the "protective" function of migration that has been found in many studies of Mexican immigrants to the United States.

12.2 Previous Research

The present chapter builds on research conducted around the globe dealing with cognitive impairment of elderly persons. Most of that research has examined either one or the other population of interest in our research. Few studies have compared Mexican Americans and Mexicans, and those that have done so often used cross-sectional data, in contrast to the longitudinal approach of this chapter. In the sections to follow, we review some previous findings regarding the factors that have been associated with cognitive impairment in various societal settings, including with Mexicans in Mexico and their counterparts in the United States.

Factors associated with cognitive decline often differ between migrants and non-migrants; thus, migration experience is a key variable for understanding cognitive decline. For example, Afable-Munsuz et al. (2013) found that Hispanic migrants in the United States have a lower incidence of diabetes than Hispanic natives; Hispanic migrants also had other health advantages such as lower rates of hypertension and obesity as well as better self-rated health (for those migrants who were less than 15 years in the United States). There exists a strong negative association between diabetes and cognition. Mejía Arango and Zuniga-Gil (2011) showed that untreated diabetes at middle age increases the risk of developing dementia in later life. A similar finding regarding the negative effect of diabetes on cognitive function was reported by Feinkohl et al. (2015).

There is wide agreement in the literature that for all ethnic groups, age and sex are associated with cognitive decline: cognitive abilities deteriorate with age (e.g., Allerhand et al. 2014; Akdag et al. 2013), and cognitive decline is often faster for women than for men (e.g., Alarabi et al. 2017; Mehta and Yeo 2016; Sohn et al. 2018). But the incidence of cognitive decline is also a function of education. Lee et al. (2003) showed that educational attainment is a stronger factor lowering the risk of dementia than other socioeconomic variables (cf. also Fyffe et al. 2011). But socioeconomic status in general matters for cognition. According to Turrell et al. (2002), the cumulative socioeconomic advantage over generations has a positive effect on cognitive function; those who were privileged while being brought up and those who established their own privileged position as adults had much better cognitive functioning than those whose upbringing and current socioeconomic status was less privileged. Similarly, Min et al. (2015) report that longer-term employment and non-manual labor improved cognitive function, and that longer work duration had an especially favorable effect on cognitive function for men and for manual laborers. While employment, and its continuation until later ages, appears to be beneficial for cognitive functions, working hours that greatly exceed the standard 40-h work week was found to have a negative effect. According to Virtanen et al. (2009:596), even when other standard variables were controlled for, "long working hours may have a negative effect on cognitive performance in middle age."

Being married has also been found in many different national settings to be advantageous to cognitive function in later life (Håkansson et al. 2009; Feng et al. 2014), although this effect is sometimes limited to males. As extension of being married, social contacts with children, friends, and participation in associations—general life-style factors—diminish cognitive decline as well (Gow et al. 2012). Marioni et al. (2015) report a similar positive association between various kinds of social activity and cognitive function, and a protective effect of feeling understood on cognitive decline. Similarly, Giles et al. (2012) found that persons with a large number of friends and access to extensive networks had more memory ability in later life than those with fewer friends and smaller networks. This finding is consistent with other research (Zunzunegui et al. 2003; Williams and Kemper 2010) that has documented how social participation and social networks slow cognitive decline in the aging process. Being able to count on friends or relative for support and having someone to talk with provides social and mental interaction beneficial to cognitive function (Fu et al. 2018).

Several researchers (Hosseini et al. 2017; Hill 2008; Van Ness and Kasl 2003) have found religiosity and spirituality to be associated with better cognitive function in later life. Although women tend to be more religious then men, the positive effect of religiosity is stronger for men (Zhang 2010). Van Ness and Kasl (2003) also found the positive effect of religiosity on cognition to be more short term than long term, i.e. the effect disappeared in later waves of their longitudinal survey.

Various aspects of physical and mental health as well as health behavior in general have been found to be associated with cognitive function in later life. People with depression in midlife have a higher risk of showing cognitive impairment at later life stages (Mehta et al. 2002; Chodosh et al. 2010); this risk increases when depression is not treated (Mejía 2016). Persons with vision and hearing impairments, especially those suffering from both, were found to be at greater risk for cognitive impairment than those with normal sensory function (Mitoku et al. 2016; Chen et al. 2017). Such impairments often require help in various aspects of daily living, including those basic activities as dressing, bathing, toileting, eating, but also others that make independent living more difficult, such as needing help with preparing a meal, shopping, managing money, or taking medicines. Needing help with either type of daily activities is associated with cognitive decline during aging (Chen et al. 2017; Chodosh et al. 2010). Much research also has identified cerebrovascular disease and heart attack as a major factor for cognitive impairment in later life (Kalaria 2012; Luchsinger et al. 2009).

Yet lifestyle factors such as diet, exercise, or sleep habit also affect cognitive ability among the elderly; physically active persons showed much less cognitive decline than those who are inactive (Alarabi et al. 2017). People who smoke, drink alcohol often, are physically inactive, and who consume small amounts of fruits and vegetables during early midlife showed much greater risk of developing cognitive decline than persons living a healthier lifestyle (Sabia et al. 2009).

This brief review of the literature about factors that have been found to be associated with cognitive function shows that to understand cognition is a function of a wide array of factors related to socioeconomic status, health, social networks, religion, and demographic variables such as age, sex, marital status, and migration. Our analysis of the different effects of factors on cognitive impairment between Mexicans in the United States (native born or immigrants) and Mexicans in Mexico draws on the findings of previous research reviewed above.

12.3 Data, Variables, and Methods

12.3.1 Data

The analysis uses two longitudinal data sets (the Mexican Health and Aging Study [MHAS] and the Hispanic Established Populations for Epidemiological Studies of the Elderly [HEPESE]. Subjects classified as cognitively normal at time 1 were followed up over an 11-year period to identify cognitive impairment at time 2 (total N = 1869 in MHAS and 902 in HEPESE). The 11-year period for HEPESE refers to 1993/4 to 2004/6, while it is 2001–2012 for MHAS. These two data sets contain a very similar set of variables of interest that make the data ideal for the present analysis, and through extensive recoding of the variables we made sure that the two models for Mexican Americans and Mexicans are truly comparable.

With panel survey data, there is always an issue of real and panel mortality, particularly in the datasets we are using, given that respondents started their participation at a later stage of their lives (age of at 50 years or age in the MHAS and at 65 years of age in the HEPESE. For sake of comparison, we selected only those respondents from the first MHAS wave who were at least aged 65. Figures 12.1 and 12.2 show the selection process for our two samples. Figure 12.1 shows that the HEPESE started with an N = 3050 in 1993–1994. Given our research question regarding the correlates of cognitive decline, our baseline survey could only include those respondents who were determined as being with cognition. This applied to 2852 persons. Of those, the analysis of their cognition (see below) yielded 2089 respondents with normal cognition. When those respondents were followed up in 2004–2006, only 902 could be interviewed again; 818 original respondents had died, 344 could not be found, and 25 refused to answer questions in wave 5.

The same selection process is shown in Fig. 12.2 for MHAS. Its first wave in 2001 included 4872 respondents of whom 4634 had cognition. Our analysis determined 3775 to have had normal cognition at the first panel wave. A total of 1869 original normal respondents could be followed up in 2012; 1409 had died, 442 could not be found, and 55 refused to participate in the 2012 wave (No. 3).

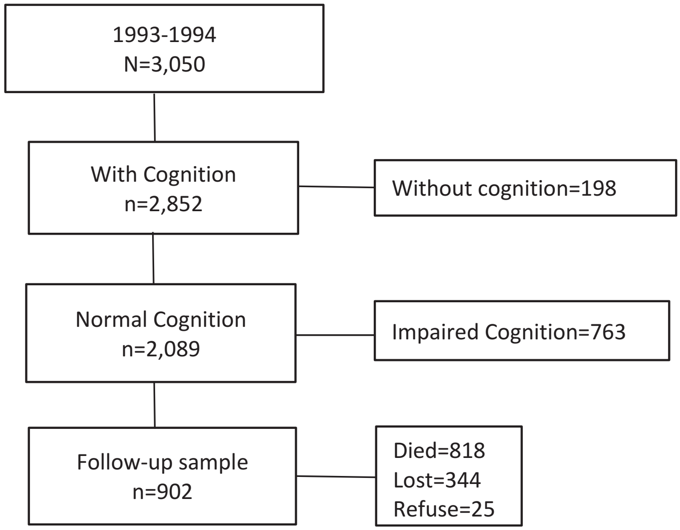

Fig. 12.1 Flowchart for the selection of the sample in the Hispanic Established Populations for Epidemiological Studies of the Elderly (HEPESE)

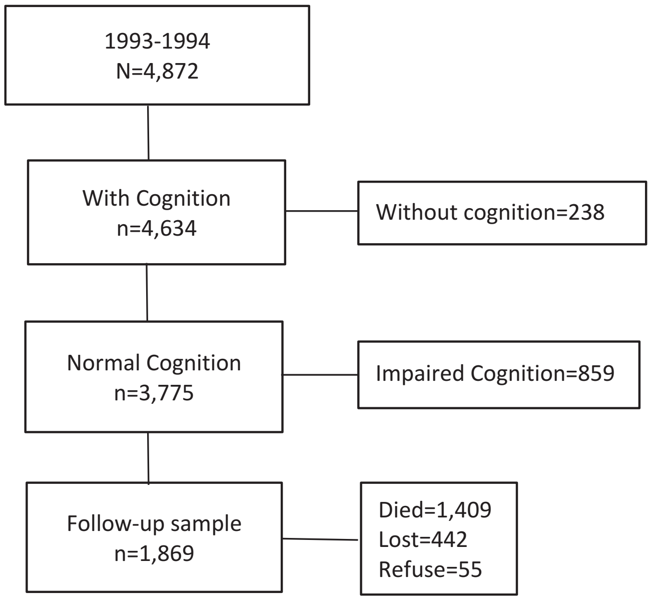

Fig. 12.2 Flowchart for the selection of the sample in the Mexican Health and Aging Study (MHAS)

A comparison of the two panel surveys shows that at baseline, 2852 subjects from the Hispanic EPESE study and 4634 from the MHAS study had cognitive data necessary to determine their cognitive status. In the EPESE sample, 73.3% had normal cognitive function and 26.7% impaired cognitive function, while in the MHAS study 81.4% were normal and 18.6% impaired. At wave 5 (HEPESE) and wave 3 (MHAS) of the studies, respectively 43.2% and 49.5% of respondents with normal cognitive function could be followed-up, 39.2% and 37.3% died, and 17.6% and18.5% were lost or had incomplete data. Missing values for the various items included in our estimated model reduced the final number of valid responses for HEPESE to N = 786 and for MHAS to N = 1631.

12.3.2 Variables

12.3.2.1 Dependent Variable

Of special importance is the definition of the dependent variable, cognitive impairment. In the Hispanic EPESE, cognition is assessed with the MMSE test. Based on age and educational level, subjects with scores above the 1st quartile in the MMSE were classified as normal at Time 1. At Time 2, MMSE scores for the followed-up subjects were classified as normal or impaired based on the 1st quartile. In the MHAS, cognition is assessed with the Cross-Cultural Cognitive Examination (CCCE), a screening measure designed by Glosser et al. (1993). Based on norms for age and education for the total score in the CCCE (Mejía Arango et al. 2015), subjects were classified as normal if the equivalent Z score was greater than −1 and impaired if it was equivalent to a Z score below −1.

12.3.2.2 Independent Variables

All independent variables chosen for the analysis are available in both data sets, and we were able to use the same codes for each variable. Based on past research as reviewed above, we selected the following categories of variables for our comparative analysis: (1) s*ociodemographic* (sex, age, and years of education); (2) *migration* (migrated, age of migration, and years in the US); (3) *family and social networks* (married, contact with children, being able to count on friends/relatives, and having someone to talk to); (4) *psychological factors* (depressive symptoms, locus of control for health, importance of religion, and volunteer or participate in non-religious activities); (5) *occupational status* (ever employed, employed at T1, and principal occupation); (6) *access to health care* (insurance and money problems for medical care); (7) *health behavior* (smoking and drinking at T1); (8) *medical conditions* (reported health, hypertension, diabetes, and heart attack); (9) *sensory limitations* (vision and hearing problems); (10) *functionality* (need help in one or more basic activities of daily living and need help in two or more instrumental activities of daily living). We expect the direction of the effect of each variable—if there is an effect for either Mexicans in the U.S. or Mexicans in Mexico—to be the same as found in the literature. Our interest is in the presence and the relative strength of the effects for both populations.

12.3.2.3 Statistical Analyses

We provide descriptive statistics (means, standard deviations, percentages) for the outcome and predictor variables. Group differences were established using analysis of variance (ANOVA) with the Scheffe procedure for pair-wise contrasts for the continuous variables and χ^2 for categorical data. We estimated logistic regression models for each category of predictor variables. All variables that had a significant predictor value were included in the final logistic regression model.

12.4 Results

12.4.1 Total HEPESE and MHAS Surveys

We carried out initial data analyses to arrive at the model which we ultimately tested and which is presented in Tables 12.1, 12.2 and 12.3. On the basis of those analyses, we dropped several variables that proved to be insignificant in both MHAS and HEPESE, and which the existent literature also deemed of only secondary importance. Although several of the factors included in the final model have no effect on cognitive impairment, we included them because past research has found them to be important. Furthermore, all factors were included if our initial data analyses found them to be statistically significant in at least one of the two samples, i.e. either MHAS or HEPESE.

We present the descriptive data in Table 12.1. They show that the characteristics of elderly residents of Mexican origin in the United States and Mexicans in Mexico differ across the categories of the independent variables. The MHAS sample is more male and less educated (measured in years of education) when compared to the HEPESE sample. MHAS respondents were younger at the time of their first migration and spent far less time in the U.S. than Mexicans in the HEPESE. While a similar proportion of respondents in both surveys are married, Mexicans in Mexico are less likely to see their children infrequently. Almost all MHAS respondents state that religion is of high important to them, compared to less than three out of four persons in the HEPESE survey. There is no difference between the MHAS and HEPESE respondents in terms of internal locus of control for health; almost all consider themselves in control of being able to influence their health through proper lifestyles.

Table 12.1 Descriptive statistics for MHAS and HEPESE surveys at baseline (percentages and means and standard deviations)

Independent variables in the model	MHAS N = 1631	HEPESE N = 786	P value
Socio-demographics			
Sex (% female)	56	63.6	**
Age	70.5 (4.9)	70.9 (4.7)	NS
Education (years completed)	3.3 (3.6)	5.3 (3.9)	**
Migration			
Age of migration to U.S.	27.6 (12)	31.7 (17.1)	**
Years lived in the U.S.	6.2 (9.1)	39.5 (18.4)	**
Family and social networks			
Married (%)	60	62.8	NS
See their children (%)	47.1	95.6	**
Psychological factors			
Internal locus of control for health (%)	92.2	93.7	NS
Importance of religion (high) (%)	97.2	70.8	**
Occupation history			
Employed now (%)	43.9	16.9	**
Ever worked (%)	77	95.3	**
Health			
No health coverage (%)	36.8	6.2	**
Money problems for medical care (%)	42.6	35.7	**
Diabetes (%)	11.5	21.4	**
Hypertension (%)	41.2	41.8	NS
Heart attack (%)	3.3	7.5	**
Cerebralvascular disease (%)	1.5	2.9	*
Sensory limitations			
Vision problems (%)	10.3	22.1	**
Hearing problems (%)	6.2	5.1	NS
Health behaviors			
Smoke (%)	29.5	27.4	NS
Functionality			
Need help in 1 > ADLs (%)	6.7	1.8	**
Need help in 2 > IADLs (%)	2.4	2.8	NS
Need help in both (%)	3.8	0.6	**

*p < .05; ** p < .01

More than twice as many Mexicans in Mexico are still employed than are Mexicans in the United States; this difference in all likelihood reflects better old-age insurance in the United States than in Mexico. In terms of life-time employment, far more HEPESE than MHAS respondents report that they were employed at some point throughout their life cycle.

The health indicators show an interesting dichotomy for the two samples. On the one hand, Mexicans in Mexico are less likely to have health insurance and more

Table 12.2 Odds ratios of factors affecting cognitive impairment among Mexicans in Mexico and in the U.S

Independent variables	MHAS		HEPES	
	OR	p	OR	p
Sex				
Masculine	1		1	
Feminine	1.19	0.18	0.74	0.07
Age				
65–69	1		1	
70–74	1.10	0.47	1.04	0.80
75–79	**1.94**	0.0001	0.66	0.058
80 +	**2.59**	0.0001	**1.85**	0.018
Education (years)	0.98	0.12	**0.94**	0.018
Age of migration				
< 18 years	0.59	0.43	**0.58**	0.05
≥ 18 years	1		1	
Years in US				
< 10 years	1		1	
≥ 10 years	0.79	0.85	0.71	0.41
Health coverage				
Yes	1		1	
No	**3.48**	0.02	1.38	0.28
Money problems for medical care				
Yes	0.42	0.13	**1.39**	0.033
No	1		1	
Hypertension				
Yes	0.94	0.62	1.03	0.84
No	1		1	
Diabetes				
Yes	**1.37**	0.08	**1.56**	0.01
No	1		1	
Heart attack				
Yes	1.23	0.53	1.24	0.44
No	1		1	
Cerebrovascular disease				
Yes	**2.92**	0.01	1.17	0.71
No	1		1	
Vision limitations				
Yes	**1.75**	0.003	**1.46**	0.037
No	1		1	
Hearing limitations				
Yes	1.53	0.07	**2.49**	0.006
No			1	
Married				

(continued)

Table 12.2 (continued)

Independent variables	MHAS		HEPES	
	OR	p	OR	p
Yes	1		1	
No	**1.54**	0.0001	1.02	0.88
See children				
Yes	1		1	
No	1.12	0.69	0.81	0.47
Locus of control for health				
Internal	1		1	
External	1.40	0.12	1.06	0.84
Importance of religion				
High	1		1	
Low	1.47	0.27	**1.43**	0.035
Employed				
Yes	1		1	
No	**1.37**	0.02	0.85	0.43
Ever worked				
Yes	1		1	
No	1.36	0.36	**2.58**	0.01
Need help in 2 or more IADLS				
Yes	**3.14**	0.001	**5.21**	0.001
No	1		1	

often have money problems to afford medical care. On the other hand, they are less than half as likely to have had a heart attack or have diabetes or cerebral-vascular diseases. A much smaller proportion also reports vision problems compared to respondents in the HEPESE survey; and far fewer Mexicans in Mexico report that they drink alcohol. There is no difference between MHAS and HEPESE respondents in their risk of having hypertension or hearing problems, and the two surveys report similar proportions of respondents needing help with two or more activities of independent daily living (IADL).

In the next analytical section, we ascertain whether the observed differences in the characteristics of the two samples have an influence on the effects of the independent variables on cognitive impairment.

The results of the final estimated regression models for all respondents in MHAS and HEPESE show the following (see Table 12.2). Of the sociodemographic variables, sex was not significant in either MHAS or HEPESE, once all other factors were controlled for. The effect of age is as expected: with increasing age, the odds of experiencing cognitive impairment also increase. However, this process begins earlier in Mexico than in the United States. Greater educational attainment only reduces the risk of cognitive impairment for Mexicans in the U.S. The age of first migration to the U.S. has no effect on the risk of cognitive impairment for Mexicans in Mexico. Nonetheless, in the U.S., Mexicans who came to the U.S. when they

Table 12.3 Odds ratios of factors affecting cognitive impairment among Mexicans in Mexico and in the U.S., by sex

	MHAS				HEPESE			
	Men		Women		Men		Women	
	OR	p	OR	p	OR	p	OR	p
Age								
65–69	1		1		1		1	
70–74	0.98	0.93	1.19	0.33	1.02	0.26	0.91	0.67
75–79	**1.72**	0.03	**2.11**	0.001	1.34	0.19	0.73	0.31
80 +	1.34	0.47	**3.72**	0.000	**4.02**	0.015	1.21	0.62
Education (years)	0.97	0.39	0.97	0.17	0.97	0.45	**0.93**	0.01
Age of migration								
< 18 years	0.59	0.43	1.32	0.80	**4.11**	0.004	1.04	0.91
≥ 18 years	1		1		1		1	0.91
Years in US								
< 10 years	0.85	0.79	0.42	0.36	0.88	0.91	1.07	0.92
≥ 10 years	1		1		1		1	
Health coverage								
Yes	1		1		1		1	
No	0.93	0.94	**5.88**	0.04	1.50	0.44	1.35	0.41
Money problems for medical care								
Yes	0.65	0.62	0.32	0.19	1.16	0.54	**1.53**	0.04
No	1		1		1		1	
Hypertension								
Yes	0.96	0.85	0.87	0.36	1.29	0.33	0.96	0.84
No	1		1		1		1	
Diabetes								
Yes	0.88	0.71	**1.92**	0.01	1.43	0.25	**1.64**	0.03
No	1		1		1		1	
Heart attack								
Yes	1.37	0.51	0.94	0.90	1.18	070	1.39	0.44
No	1		1		1		1	
Cerebrovascular disease								
Yes	**6.84**	0.009	1.87	0.28	1.66	0.42	0.69	0.56
No	1		1		1		1	
Vision limitations								
Yes	1.63	1.11	**1.71**	0.02	1.39	0.28	**1.54**	0.05
No	1		1		1		1	
Hearing limitations								
Yes	1.10	0.78	**2.24**	0.02	2.48	0.09	**2.74**	0.02
No	1		1		1		1	
Married								
Yes	1		1		1		1	
No	**1.80**	0.037	1.10	0.61	1.64	0.22	1.11	0.61

(continued)

Table 12.3 (continued)

	MHAS				HEPESE			
	Men		Women		Men		Women	
	OR	p	OR	p	OR	p	OR	p
See children								
Yes	1		1		1		1	
No	0.92	0.67	0.83	0.34	0.79	0.73	1.02	0.99
Locus of control for health								
Internal	1		1		1		1	
External	**2.25**	0.03	1.03	0.91	1.48	0.41	0.75	0.54
Importance of religion								
Low	0.98	0.97	**3.57**	0.05	1.20	0.46	1.46	0.27
High	1		1		1		1	
Employed								
Yes	1		1		1		1	
No	1.00	0.93	**2.05**	0.01	0.60	0.31	0.79	0.33
Ever worked								
Yes	1		1		1			
No	**5.31**	0.03	1.16	0.66	**2.79**	0.05	2.33	0.11
Need help in 2 or more IADLS								
Yes	4.34	0.10	1.79	0.27	3.00	0.21	**5.36**	0.01
No	1		1		1		1	

were younger than 18 had a significantly reduced risk of cognitive impairment than others who arrived in the U.S. for the first time at a later age.

Although very similar proportions of Mexicans in both samples reported being married, not being married increased the likelihood of cognitive decline among Mexicans but not for Mexican Americans. The stigma of not being married might be greater in Mexico than in the U.S., leading to more stress among MHAS respondents. Not seeing one's children was not a predictor of cognitive decline for either group of Mexicans, although the descriptive data showed that Mexicans in Mexico are far less likely to see their children than are Mexicans in the U.S.

Regarding the category of occupation history variables, not being employed at baseline increased the odds of cognitive impairment for Mexicans, while for Mexican Americans the odds only increased for those who had never been employed in their life. We do not have a full explanation for why the two employment variables, respectively, have a significant effect only on one population of Mexicans but not the other. But we point to the descriptive statistics in Table 12.1: almost half all older Mexicans in Mexico are still employed, compared with only 17% of Mexicans in the U.S. The lack of employment for Mexicans in Mexico may thus signify fewer social contacts which has been found to be a source of cognitive impairment. The same explanation could apply to never having been employed in one's life: virtually all Mexicans in the U.S. report as having been employed at one point; signifying possible social isolation which, again, has been linked to cognitive decline.

Six of the eight health variables included in the model had an effect on the likelihood of cognitive decline, although vision impairment and diabetes are the only two health factors that increases the risk of cognitive decline for both groups of Mexicans. Two other health factors are significant only for Mexicans in Mexico: those suffering from cerebrovascular disease have an increased risk of cognitive impairment, and the same holds for persons without health insurance. For Mexicans in the U.S., on the other hand, having money problems to cover medical care, diabetes, and hearing limitations increased the odds for cognitive impairment. For neither group of Mexicans did the absence of health insurance or a heart attack increase the odds of cognitive impairment in later life. Finally, needing help in two or more instrumental activities of daily living at baseline increased the odds of cognitive decline for Mexicans in Mexico and in the U.S.

The sense of having internal control over one's health conditions had no effect on Mexicans in either country. Mexicans for whom religion is of low importance had greater odds of developing cognitive impairment than highly religious Mexicans in the U.S.; importance of religion had no effect on cognitive function for Mexicans in Mexico, perhaps because almost all MHAS respondents stated that religion is highly important to them.

We now turn to the sex-specific regression results (see Table 12.3). In general, the factors that had significant effects on the odds of cognitive impairment in the two full samples remained significant in the sex-specific analysis. But a clear pattern emerges: Much of the significance in the full model (Table 12.2) can be attributed to females. In fact, for both Mexicans in Mexico and Mexicans in the U.S., twice as many factors explain the increased odds of developing cognitive impairment for women (six factors) compared to men (three factors). For example, the significance of not having health insurance coverage for cognitive function that is seen in the full model applies only to women and not to men. The same applies to vision impairment and not being employed. In other cases, the sex-specific analysis shows that the previous full-model result applies only to males, such as with cerebrovascular disease, and it this case the effect is especially strong. In yet another way, the sex-specific analysis brings out the importance of a certain factor for cognition that was not seen for the full sample; such is the case with "ever worked" which was not significant in the full model but greatly increases the odds for cognitive impairment among when then they state at baseline that they have never worked. In some cases, the significance of a factor for cognition that was shown in the full model disappears when the analysis is done separately for men and women; this can be seen with the importance of religion in the HEPESE survey. Accordingly, neither males nor females have greater odds of developing cognitive impairment if they state that religion is not very important to them.

12.5 Conclusions and Discussion

In sum, the research we report in this chapter indicates that the proportion of elders showing cognitive decline after a 10-year period is higher among Mexicans in the United States (33%) than among Mexicans in Mexico (23%). Sex differentials show divergent trends in the U.S. and Mexico: while Mexican women in Mexico have a higher incidence of cognitive decline than their male counterparts, the reverse is the case for Mexican Americans. Combined with the detrimental effect on cognitive impairment of having migrated to the United States prior to age 18, these findings provide support for a suggested hypothesis of a negative association between acculturation and health status among Mexican migrants. The results also showed a fairly common pattern of risk factors for cognitive impairment for both Mexicans and Mexican-Americans with regard to so-called "strong" factors such as age, education, health, and sensory and functional limitations. However, different patterns emerged for the effects of social factors (family, networks, work and occupation) on cognitive impairment of Mexicans and Mexican Americans. Finally, the results clearly demonstrate the importance of differentiating an analysis of risk factors for cognitive decline by sex. Not only did our models show that in many instances, risks factors for cognitive decline had different effects for women than for men, the findings also showed that these sex differentials differ between Mexicans and Mexican Americans.

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Part V
Issues in Social Demography

Chapter 13
The Urban Hierarchies of China and the United States

Qian Xiong and Dudley L. Poston, Jr

13.1 Introduction

In the year 2012, China had 177 urban agglomerations (referred to as high-density built-up areas, or "shiqu" in Chinese) with populations of over 750 thousand inhabitants. These 177 areas are the commonly known major "cities" of China. Of these cities, Chongqing had the largest population numbering almost 17.7 million inhabitants. Shanghai followed at almost 13.5 million, and then Beijing at almost 12.2 million. Of special interest in this chapter is the fact that even though Chongqing has more inhabitants than Shanghai which has more inhabitants than Beijing, we will show that Beijing is the most "dominant" of the cities in China and occupies the top place in the urban system. By comparison, the United States in the year of 2012 had 69 urban agglomerations (referred to in the U.S. as metropolitan statistical areas) with populations of 750 thousand or more. The New York-Northeastern New Jersey-Long Island area has the largest population at over 18.9 million, followed by Los Angeles-Long Beach-Santa Ana at over 12.8 million, and Chicago-Joliet-Naperville at almost 9.5 million. It turns out that these three largest metro areas in the U.S. are also the three most "dominant" of all the U.S. metro areas in the same order as the size of their populations. Our analysis will demonstrate that these giant cities usually rank at the top layer of the country's urban system.

Here are two notes about terminology. First, in China these urban agglomerations are officially known as high-density built-up areas (Chan 2007), and in the

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U.S. they are known as metropolitan statistical areas (MSAs). From here on in this chapter, we will refer to the urban agglomerations both in China and in the U.S. as "cities," even though an urban agglomeration means more than a city. Two, the names of most of the MSAs in the U.S. consist of two or more names, reflecting the fact that two or more urban core areas constitute the MSA (see the listings in Table 13.6 below). However, the name only of the core area, e.g., New York or Los Angeles or Chicago, instead of the full names will be used.

Too frequently, cities are discussed as if they exist by themselves and are isolated from other cities. Geographically and spatially, cities do exist by themselves, as each city occupies a space that is not shared by another city. Nighttime photographs of the complete country of China and the U.S. show representations of all the cities of the two countries. For instance, the China photograph shows that Shanghai occupies a certain geographical area on the east coast of China, and Beijing occupies another area in the north. The U.S. map shows that New York City, Los Angeles and Chicago occupy specific geographical areas on the east and west coasts and in the upper Midwest, respectively. While these maps are informative in showing geographic locations, they do not show the complex and dynamic relations of each city with the others.

"Urban systems" are the focus of this chapter. Cities perform various functions which make them dependent on, and/or interdependent of, other cities. Some cities are dominant at the country level, that is, they exert tremendous amounts of influence and control over all the other cities in the country. The influence of some of the super cities even extend beyond the country to other countries. Some cities are dominant only in their geographical regions within the country. Still other cities do not exert much dominance but instead are dominated by other cities. In this chapter we thus aim to delineate the hierarchical structure of the urban system. Such a consideration is grounded in the work of human ecologists who described an "urban system" as cities being linked with one another (Gras 1922; McKenzie 1933; Bogue 1950; Bean et al. 1972).

In this chapter we first introduce the concept of "urban system" and review its initial development in the mainly Western literature on metropolitan dominance and integration. Using data from the *2013 China City Statistical Yearbook* (State Statistical Bureau 2013) and from the U.S. *2012 Economic Census* (U.S. Census Bureau 2012), we then configure quantitatively the urban systems of China and the United States as of the year of 2012. We compute metropolitan dominance scores for each of China's 177 large cities, and for each of the 69 large cities of the U.S. Our results indicate that Beijing is the most dominant city in China, although not the largest in population, and is followed closely by Shanghai. And we show that New York City is the most dominant city in the U.S. Beijing and Shanghai in terms of their dominance in China are comparable to New York City. We argue that the dominance of a city is not purely determined by its population size or administrative role, and that there is a hierarchical relationship in the urban system.

13.2 Metropolitan and Urban Dominance

The relationships of cities with their hinterlands and with the other cities in their countries and in the world may be analyzed either quantitatively (in terms of population size) or qualitatively (in terms of functional roles). Although city population size is often a surrogate or proxy indicator for functional dominance, i.e., the larger the city, the greater its dominance, the empirical correspondence of the two is far from perfect. Vance and Sutker (1957) noted more than 60 years ago that there is much more to metropolitan and urban dominance than large population size. “Any city with a large population is usually referred to as a metropolis, but it may be well to point out that, while all metropolises are large cities, not all large cities are metropolises. Population size is a concomitant; function is the keynote” (Vance and Sutker 1957: 103–104; see also Bean et al. 1972).

Human ecologists have long recognized that a territorial division of labor among cities of an urban system is generated by an increase in the number and size of cities. The differentiation of functions among these cities inevitably leads to a hierarchical structure within the system. Early analyses of urban functions, however, mainly conducted by western scholars, tended to focus primarily on the relationships between the nodal cities and their immediate hinterlands, and not on the relationships between the nodal cities (Gras 1922; McKenzie 1933; Bogue 1950). Overall, these studies, in the words of human ecologist R. D. McKenzie, gave a “clear picture of metropolitan organization … for some … metropolises are regional in character, some are interregional, and one or two are international in their influence” (McKenzie 1933: 245).

One of the first studies of the metropolitan hierarchy was *Metropolis and Region* by Otis Dudley Duncan and his colleagues (1960). They examined U.S. metropolitan areas with populations of at least 300,000 in 1950 and developed a sevenfold quasi-hierarchical classification of the cities with respect to their manufacturing, financial and commercial functions. A number of replications and extensions (cf., Bean et al. 1972; Wanner 1977; South and Poston 1980; South and Poston 1982; Eberstein and Frisbie 1982) followed the path breaking research of Duncan and his colleagues.

Particularly important for this chapter are the ecological studies of the metropolitan areas of the southern region of the United States conducted by Vance and Sutker (1957) and by Galle and Stern (1981) (see also Duncan and Lieberson 1970). These analyses were grounded in the theoretical rationale of human ecology (Poston and Frisbie 1998, 2019), and they illustrate the methodological approach we use in this chapter in our investigations of metropolitan dominance in China and in the U.S.

The Vance and Sutker (1957) and Galle and Stern (1981) studies focused on the organizational features of U.S. southern cities. The cities were seen as the agents for organizing their hinterland resources, for providing intermediate product processing and transshipment points for goods flowing to other areas, and for developing and maintaining their regions' financial flows (Galle and Stern 1981). The urban centers differed from one another according to the degree to which they exhibited these attributes of organizational control and integration; population size of the cities was not considered in the calculations and equations. The more the above attributes were present in a city, the higher the rank of the city in the urban hierarchy. This vertical dimension of urban differentiation was usually captured by reviewing a city's activities in wholesaling, transportation, administration and finances (Vance and Sutker 1957; Duncan et al. 1960; Galle and Stern 1981; Meyer 1984, 1986; Marshall and Stahura 1986). The greater the absolute concentration of these activities in the city, the greater its possession of power and authority that can be used to exercise over other cities or coordinate interactions with other cities.

To delineate the patterns of the urban hierarchy, Vance and Sutker (1957) gathered data reflecting the degree of dominance, which they defined as the capacity of a city to dominate over other cities. They also gathered data on the underpinnings of the city for building its market and amassing wealth, which they referred to as the ability of a city to maintain an infrastructure to support its sustenance organization and population in day-to-day activities. They measured the degree of dominance with three indices: (1) wholesale sales, (2) business service receipts, and (3) number of branch offices. They gauged the extent of the city's underpinnings with three indices: (4) retail sales, (5) bank clearings, and (6) value added by manufacturing. Vance and Sutker gave the first three indices twice the weight of the latter three indices owing to their decidedly greater importance in the delineation of metropolitan dominance. This methodology is relatively simple, but is straightforward and has shown a remarkable degree of robustness in the specification of the U.S. urban system in the South.

The analyses of the urban system of China also deserve attention. Up until the 1980s, quantitative analyses of China's urban structure were hampered by the lack of adequate statistical materials. There had been a lot of attention directed to historical and descriptive studies of particular Chinese cities and regions (cf., Murphey 1974; Kapp 1974; Chan 1981; Sit 1984, 1995; Vogel 1989; Yeung and Chu 1994, 2000; Kwok and So 1995; Chung 1999). But earlier research on cities in China were criticized for providing "very little guidance [about the statistical structure] … of the urban system as a whole" (Chen 1988: 227; see also Chan 2007). With the release in the 1980s, and continuing on an almost yearly basis of several volumes of statistical and urban yearbooks, as well as the results of the 1982 and 1990 population censuses, several scholars turned attention to investigations of the structure and dynamics of China's cities (Goldstein 1985; Poston 1987; Chen 1988; Poston and Gu 1989; Poston et al. 1990). Poston and Gu (1989) analyzed the hierarchical structure of the twenty cities in China with populations in 1984 of at least two million. They found the hierarchy of China's giant cities to be characterized by three super and national metropolises, namely, Shanghai, Beijing, and Tianjin; the remaining seventeen metropolises were shown to have decreasing amounts of dominance and control, from the 4th ranked Guangzhou to the 20th ranked Fushun. The twenty cities were analyzed in terms of the organization of the resources of their hinterlands and their levels of dominance and control. Poston et al. (1990) extended the above analysis to the 295 largest cities of China, as of 1985. Using a similar approach, they classified the cities into nine categories. They concluded that Shanghai was a Super Metropolis with overwhelming influence and dominance over all the other cities of China. Shanghai was comparable in influence to New York, London and Tokyo and other Super Metropolises around the world.

This chapter follows the methodology of the previous work in the U.S. and China, and uses recent data to draw up pictures of the urban systems in these two countries.

13.3 Data and Methods

The Chinese definition of a city includes the actual city and its surrounding urban and rural hinterlands. In China, many of the large cities include extensive population concentrations in built-up urban areas and in the outlying rural areas. Some Chinese cities have no rural counties and others have many (Chan 2007). To illustrate, Beijing has nine rural counties, and Nanjing and Changchun each has five. Chen (1988) has noted that the rural parts of the larger cities "bear some resemblance to the rural fringe (of western metropolises), i.e., that subzone of the rural-urban fringe contiguous with the urban fringe, and have a lower density of occupied dwellings than the median density of the total rural-urban fringe, a higher proportion of farm than nonfarm and vacant land, and a lower rate of increase in population density, land use conversion, and commuting" (Chen 1988: 231; see also, Pryor 1968). Hence researchers studying Chinese cities often restrict their units of analysis to the strictly urban parts of the cities (Goldstein 1985; Chen 1988; Poston et al. 1990). This part of the city is structurally similar to the U.S. Metropolitan Statistical Area (MSA).

The definition of the MSA in the United States is the following: An MSA has "at least one urbanized area of 50,000 or more population, plus adjacent territory that has a high degree of social and economic integration with the core as measured by commuting ties…MSAs are delineated in terms of whole counties (or equivalent entities) …" (Office of Management and Budget 2013: 2). As of 2012, there were 388 metropolitan areas, comprising over 85% of the U.S. population. Our research in this chapter focuses on the largest of the MSAs, namely, those 69 metropolitan areas with populations of over 750,000.

For our analysis of China's urban hierarchy, we use data from the *2013 China City Statistical Yearbook* for the 177 Chinese cities with populations in 2012 of at least 750 thousand. For each of selected China's largest cities with population size, we gathered the same general kinds of dominance and integration data used in the analyses reviewed above by Vance and Sutker, Galle and Stern, and Poston and associates. We were unable to replicate perfectly their measures, although the data are similar. Recall that these earlier studies used two categories of measures for the cities; one group of measures reflected the dominance of the city over other cities, and the other group reflected the underpinnings of the city in building its market and amassing wealth. The degree of dominance of a city may be best measured with information on the organization of the industrial structure of the city, and the organization of its transportation and communication facilities.

To analyze the degree of dominance of the city, we gathered for each of China's 177 largest cities the following measures: (1) the number of industrial enterprises (INDUSTRIAL-UNIT); (2) the value (in 10,000 RMB.) of wholesale and retail trade (WHOLESALE-RETAIL-VALUE); (3) the volume of freight (in 10,000 tons) shipped into and out of the city via air, highway, railroad and water (FREIGHT); (4) the value of deposits (in 10,000 RMB.) of financial institutions (FINANCE-VALUE); and (5) the value of telecommunication income (in 10,000 RMB.) (TELECOMMUNICATION-VALUE).

To represent the local underpinnings of the city for developing its own market and amassing wealth, we gathered data on (6) the value (in 10,000 RMB.) of expenditures directed to the maintenance of urban utilities (URBAN-UTILITIES-VALUE); (7) the value (in 10,000 RMB.) of retail sales (RETAIL-VALUE); (8) the number of colleges and universities (COLLEGES); (9) the number of hospitals (HOSPITALS); and (10) the number of theatres and cinemas (THEATRES). The means and standard deviations of these ten variables are reported in Table 13.1.

We followed the same approach, as closely as possible, in our analyses of the urban hierarchy of the U.S., though it was not possible to gather exactly the same kinds of data. Our analysis of the urban system of the U.S. uses data from the *2012 Economic Census* for the 69 MSAs of the U.S. with populations in 2012 of at least 750 thousand. To measure the degree of urban dominance in the U.S. cities, we gathered data for each of the cities on the following five indexes: (1) number of manufacturing establishments (MANUFACTURING-UNIT); (2) number of wholesale trade establishments (WHOLESALE-UNIT); (3) number of transportation

Table 13.1 Means and standard deviations, metropolitan dominance and local underpinnings variables: 177 cities with populations of 750 K+: China, 2012

	Mean	Standard deviation
Metropolitan dominance variables		
Number of industrial enterprises	755.92	1255.31
Wholesale and retail trade value (in 10,000 RMB)	19,300,000	59,900,000
Freight volume (in 10,000 Tons)	16,959.50	14,125.16
Value of deposits of financial institutions (in 10,000 RMB)	34,800,000	83,200,000
Value of telecommunication income (in 10,000 RMB)	517,109.40	697,277.40
Local underpinnings variables		
Value of expenditures on maintenance of urban utilities (in 10,000 RMB)	396,742.40	793,270.20
Value of retail sales (in 10,000 RMB)	676,6064	10,900,000
Number of colleges and universities	12.06	17.61
Number of hospitals	92.58	99.92
Number of theatres and cinemas	9.53	19.47

Table 13.2 Means and standard deviations, metropolitan dominance and local underpinnings variables: 69 cities with populations of 750 K+: United States, 2012

	Mean	Standard deviation
Metropolitan dominance variables		
Number of manufacturing establishments	2484.03	3026.75
Number of wholesale trade establishments	4,60.35	6109.14
Number of transportation and warehousing establishments	1718.93	2269.21
Number of finance and insurance establishments	4206.28	4583.21
Number of information establishments	1346.42	1996.54
Local underpinnings variables		
Number of utility establishments	96.23	91.82
Number of retail trade establishments	8693.65	10,752.45
Number of educational services establishments	706.51	934.99
Number of health care and social assistance establishments	7475.52	9190.09
Number of arts, entertainment, and recreation establishments	1128.87	2072.04

and warehousing establishments (TRANSPORTATION/WAREHOUSING-UNIT); (4) number of finance and insurance establishments (FINANCE-UNIT); and (5) number of information establishments (INFORMATION-UNIT).

To measure the extent of the local underpinnings of each U.S. city for developing its market and attaining wealth, we gathered data on the following five items: (6) number of utility establishments (UTILITY-UNIT); (7) number of retail trade establishments (RETAIL-UNIT); (8) number of educational service establishments (EDUCATION-UNIT); (9) number of health care and social assistance establishments (HEALTH CARE-UNIT); and (10) number of arts, entertainment and recreation establishments (ARTS-UNIT).

The means and standard deviations of these ten variables are shown in Table 13.2.

Following the procedures used by Vance and Sutker, Galle and Stern, and Poston and associates, we next calculated standardized scores (z-scores) for each of the ten measures for each city, allowing us to now have measures for all the cities with the same metric, the standard deviation. The mean value of a measure was subtracted from the actual score of the city on the measure, and then divided by the standard deviation of the measure; this produced a standardized score (z-score). The distribution of z-scores has a mean of 0 and a standard deviation of 1. A z-score value for a city of 2.0 for a particular measure would indicate that the city's score on that measure is two standard deviations above the mean of the measure. A z-score of −2.0 would mean that the city's score on that measure is two standard deviations below the mean of the measure. If a city has a z-score of zero, this means that the city's score on the measure is the same as the average score of all the cities on the measure.

A z-score for a city on a measure is calculated with this formula:

$$\mathbf{Z} = (\mathbf{X} - \mathbf{Mean}) / \mathbf{SD}$$

where:

X is a city's actual score on the measure;

Mean is the average value across all the cities on the measure;

SD is the standard deviation across the cities on the measure.

In order to show the process of how a Z-score is calculated, Table 13.3 presents the actual values and the z-scores on each of the ten measures for Shanghai (which, along with Beijing, is one of the two most dominant cities in China), and Suihua (the least dominant city in China; it is located in west-central Heilongjiang Province).

On the first measure, the number of industrial enterprises (INDUSTRIAL-UNIT), Shanghai has 3516 such enterprises, and Suihua only 19. The mean and standard deviation for this measure are 755.9 and 1225.3, respectively (see Table 13.1). Shanghai's z-score on the INDUSTRIAL-UNIT measure is 2.2 = (3516–755.9)/1225.3. The z-score of Suihua on the INDUSTRIAL-UNIT measure is −0.6 = (19–755.9) /1225.3). These values inform us that Shanghai's score on the number of industrial enterprises variable is 2.2 standard deviations greater than the average score of the 177 Chinese cities on this measure. Alternately, Suihiua's score is 0.6 of a standard deviation less than the average score across the 177 Chinese cities. Shanghai has large z-scores on all ten of the measures (Table 13.3), indicating its (and later we will see Beijing's) tremendous overall importance in China and its control over the other large cities of China.

In a similar vein, Table 13.4 presents the actual values and the z-scores for New York on each of the ten measures, as well as the values for the McAllen MSA. The calculations show that New York is 4.6 standard deviations greater than the average score on number of manufacturing establishments across the 69 cities; conversely, McAllen is 0.7 of a standard deviation less than the average.

After calculating the z-scores for the cities of China and for the U.S on the ten different measures, we then followed the weighting approach of the earlier studies of the metropolitan hierarchy. That is, we multiplied by two the z-scores of measures that directly reflect dominance and control (i.e. the first five measures) for each city, while not weighting the z-scores on local underpinnings and integration (i.e. the other five measures). Finally, the weighted z-scores for the ten measures for each city were added up to provide a composite index of metropolitan dominance. The formula is:

$$\mathbf{DOMINANCE} = \mathbf{2}\sum_{i=1}^{n} \boldsymbol{Z}_i + \sum_{j=1}^{n} \boldsymbol{Z}_j$$

where:

$\boldsymbol{Z}_i$ is a vector of z-scores for indicators of dominance; $\boldsymbol{Z}_j$ is a vector of z-scores for indicators of local underpinnings.

The dominance scores and ranking are shown in Table 13.5 for the Chinese cities and in Table 13.6 for the U.S. cities.

Table 13.3 Original values on dominance and local underpinnings variables, and standardized scores (Z-scores): Shanghai and Suihua, China, 2012

	Original values		Z-scores	
	Shanghai	Suihua	Shanghai	Suihua
Metropolitan dominance variables				
Number of industrial enterprises	3516	19	2.2	−0.6
Value of wholesale and retail trade (in 10,000 RMB)	522,054,268	27,3621	8.4	−0.3
Freight volume (in 10,000 Tons)	26,291	3849	0.7	−0.9
Value of deposits of financial institutions (in 10,000 RMB)	773,016,228	2,132,946	8.9	−0.4
Value of telecommunication income (in 10,000 RMB)	4,880,146	15,172	6.3	−0.7
Local underpinnings variables				
Value of expenditures on maintenance of urban utilities (in 10,000 RMB)	8,106,944	8028	9.7	−0.5
Value of retail sales (in 10,000 RMB)	75,142,586	570,554	6.3	−0.6
Number of colleges and universities	91	1	4.5	−0.6
Number of hospitals	591	29	5.0	−0.6
Number of theatres and cinemas	194	3	9.5	−0.3
Ranking			2	177
Index			87.71	−8.55

Table 13.4 Original values on dominance and local underpinnings variables, and standardized scores (Z-scores): New York-Northern New Jersey-Long Island, and McAllen-Edinburg-Mission, United States, 2012

	Original values		Z-scores	
	New York-Northern New Jersey-Long Island, NY-NJ-PA Metro Area	McAllen-Edinburg-Mission, TX Metro Area	New York-Northern New Jersey-Long Island, NY-NJ-PA Metro Area	McAllen-Edinburg-Mission, TX Metro Area
Metropolitan dominance variables				
Number of manufacturing establishments	16,232	268	4.60	−0.72
Number of wholesale trade establishments	38,176	915	5.61	−0.53
Number of transportation and warehousing establishments	14,522	487	5.68	−0.54
Number of finance and insurance establishments	29,065	825	5.45	−0.73
Number of information establishments	11,587	141	5.16	−0.60
Local underpinnings variables				
Number of utility establishments	580	16	5.29	−0.86
Number of retail trade establishments	78,193	2219	6.50	−0.60
Number of educational services establishments	6380	75	6.11	−0.67
Number of health care and social assistance establishments	60,802	2048	5.84	−0.59
Number of arts, entertainment, and recreation establishments	11,122	96	4.86	−0.50
Ranking			1	69
Index			81.62	−9.46

13.4 Analysis and Findings

Table 13.5 ranks the 177 Chinese cities with populations of 750 thousand or more in the year of 2012 according to the values of their metropolitan dominance scores. Based on the distribution of the dominance scores (Z scores), these 177 cities were classified into nine categories (Table 13.7), which together constitute the metropolitan hierarchy of China.

Table 13.5 Population size, composite index scores, and composite index rankings: 177 Cities, China, 2012

Name	Mid-year 2012 population (in 10,000)	Ranking	Index
Super metropolitan centers			
Beijing	1216.8	1	87.71
Shanghai	1354.5	2	86.34
National metropolitan centers			
Guangzhou	674.6	3	44.12
Chongqing	1774.9	4	42.92
Shenzhen	277.8	5	38.52
Tianjin	814.4	6	32.56
Hangzhou	442.9	7	23.69
Chengdu	549.5	8	20.74
Wuhan	514.1	9	20.71
Nanjing	552.5	10	20.24
Regional metropolitan centers			
Xi'an	570.8	11	17.17
Shenyang	520.6	12	16.82
Foshan	376.2	13	16.12
Suzhou	327.2	14	15.39
Sub-dominant regional metropolitan centers			
Ningbo	225.4	15	12.68
Qingdao	362.6	16	11.02
Jinan	350.8	17	9.96
Dongguan	185.9	18	9.70
Dalian	298.2	19	9.49
Zhengzhou	313.0	20	9.41
Hefei	220.3	21	8.82
Harbin	471.4	22	8.66
Kunming	273.1	23	8.59
Changsha	297.3	24	7.95
Wuxi	240.3	25	7.20
Provincial metropolitan centers			
Fuzhou	191.0	26	5.41
Nanning	273.7	27	5.34
Changzhou	229.7	28	5.05
Taiyuan	283.9	29	4.86
Shijiazhuang	246.9	30	4.51
Changchun	363.9	31	4.26
Zibo	280.9	32	3.87
Xiamen	188.1	33	3.77
Urban centers with provincial influence			
Nantong	211.8	34	3.00
Zhongshan	151.4	35	2.88

(continued)

Table 13.5 (continued)

Name	Mid-year 2012 population (in 10,000)	Ranking	Index
Tangshan	322.8	36	2.79
Linyi	247.7	37	2.14
Wenzhou	148.7	38	1.99
Urumqi	247.7	39	0.89
Quanzhou	103.6	40	0.48
Nanchang	274.6	41	0.36
Baotou	144.6	42	0.30
Yantai	180.0	43	0.17
Urban centers with limited provincial influence			
Weifang	183.0	44	−0.01
Xuzhou	318.3	45	−0.03
Taizhou	156.4	46	−0.14
Guiyang	224.2	47	−0.66
Handan	148.5	48	−0.68
Baoding	108.2	49	−1.46
Yangzhou	230.0	50	−1.47
Zaozhuang	225.5	51	−1.48
Hohhot	120.2	52	−1.50
Huizhou	137.8	53	−1.51
Lanzhou	207.7	54	−1.59
Wuhu	123.7	55	−1.63
Jiaxing	84.6	56	−1.75
Zhanjiang	163.3	57	−1.80
Hainan	219.7	58	−1.91
Lu’an	187.2	59	−1.92
Jining	118.0	60	−1.96
Hengyang	99.5	61	−2.05
Luoyang	182.5	62	−2.11
Shantou	523.7	63	−2.16
Zhuhai	106.3	64	−2.21
Qiqihar	139.9	65	−2.35
Fuyang	211.8	66	−2.36
Heze	151.3	67	−2.73
Anshan	152.0	68	−2.75
Huzhou	109.4	69	−3.02
Yueyang	117.3	70	−3.04
Jinhua	93.8	71	−3.04
Liuzhou	114.5	72	−3.10
Nanyang	192.6	73	−3.11
Yancheng	165.9	74	−3.11
Datong	156.7	75	−3.19
Huai’an	282.1	76	−3.27

(continued)

Table 13.5 (continued)

Name	Mid-year 2012 population (in 10,000)	Ranking	Index
Daqing	134.1	77	−3.31
Zhenjiang	103.5	78	−3.38
Zhuzhou	94.4	79	−3.44
Suining	150.9	80	−3.53
Ezhou	105.3	81	−3.61
Haikou	162.0	82	−3.62
Anyang	111.0	83	−3.70
Shangqiu	180.2	84	−3.71
Yichang	125.0	85	−3.74
Chenzhou	83.4	86	−3.79
Jilin	183.0	87	−3.80
Urban centers with limited sub-provincial influence			
Xiangyang	225.5	88	−4.00
Bengbu	92.9	89	−4.02
Jiangmen	139.0	90	−4.10
Yinchuan	98.7	91	−4.13
Taizhou	83.1	92	−4.16
Yingkou	91.3	93	−4.18
Dongying	83.7	94	−4.36
Ma An Shan	82.1	95	−4.45
Rizhao	126.4	96	−4.45
Huainan	180.9	97	−4.45
Lianyungang	96.1	98	−4.49
Tai'an	159.0	99	−4.53
Pingdingshan	104.4	100	−4.53
Changde	141.4	101	−4.62
Suzhou	188.0	102	−4.66
Jiaozuo	90.5	103	−4.75
Mianyang	123.5	104	−4.75
Xinxiang	102.9	105	−4.76
Langfang	81.3	106	−4.85
Zhumadian	81.4	107	−4.86
Guilin	75.9	108	−4.91
Liaocheng	116.1	109	−4.98
Qinzhou	141.8	110	−5.00
Jinzhou	93.7	111	−5.01
Linfen	82.3	112	−5.09
Xingtai	91.2	113	−5.10
Xianyang	90.8	114	−5.11
Xiangtan	88.5	115	−5.11
Fushun	144.3	116	−5.13
Tongliao	84.6	117	−5.17

(continued)

Table 13.5 (continued)

Name	Mid-year 2012 population (in 10,000)	Ranking	Index
Suqian	163.6	118	−5.18
Urban centers			
Qinhuangdao	90.9	119	−5.27
Nanchong	195.0	120	−5.27
Chifeng	136.7	121	−5.31
Baoji	143.3	122	−5.45
Huaibei	110.6	123	−5.50
Yichun	108.4	124	−5.54
Leshan	114.1	125	−5.55
Fuzhou	109.9	126	−5.55
Liaoyang	81.3	127	−5.60
Bozhou	164.8	128	−5.63
Xinyang	152.0	129	−5.68
Yiyang	134.5	130	−5.72
Zunyi	87.2	131	−5.76
Luzhou	147.9	132	−5.79
Xining	91.4	133	−5.81
Yulin	103.9	134	−5.82
Weinan	85.3	135	−5.96
Xuancheng	86.6	136	−5.97
Putian	218.4	137	−5.97
Benxi	94.6	138	−5.98
Jingzhou	112.8	139	−6.05
Shaoguan	92.8	140	−6.07
Maoming	135.0	141	−6.11
Quzhou	83.2	142	−6.19
Zhangjiakou	90.0	143	−6.29
Xinyu	86.8	144	−6.34
Pingxiang	86.6	145	−6.34
Yibin	124.7	146	−6.46
Guangyuan	93.2	147	−6.47
Guigang	191.2	148	−6.51
Yongzhou	116.2	149	−6.53
Ziyang	109.7	150	−6.59
Zigong	150.2	151	−6.63
Mudanjiang	88.7	152	−6.68
Dandong	78.7	153	−6.75
Bazhong	138.5	154	−6.78
Bijie	113.1	155	−6.79
Huludao	98.8	156	−6.82
Luohe	139.8	157	−6.90
Neijiang	142.0	158	−6.94

(continued)

Table 13.5 (continued)

Name	Mid-year 2012 population (in 10,000)	Ranking	Index
Kaifeng	86.3	159	−6.94
Xiaogan	95.7	160	−6.99
Jiamusi	81.3	161	−7.00
Ankang	101.6	162	−7.01
Laiwu	126.6	163	−7.02
Fuxin	78.0	164	−7.14
Meishan	86.3	165	−7.41
Jixi	85.5	166	−7.49
Wuwei	102.3	167	−7.63
Guang'an	125.7	168	−7.67
Tianshui	132.0	169	−7.68
Tongchuan	76.0	170	−7.76
Laibin	109.4	171	−8.00
Anshun	76.0	172	−8.01
Zhaotong	84.9	173	−8.14
Yichun	80.6	174	−8.16
Baoshan	90.8	175	−8.44
Hezhou	110.7	176	−8.52
Suihua	88.9	177	−8.55

We defined the first category as "Super Metropolitan Centers," meaning that they have overwhelming influence and dominance over all the cities of China. This is indicated empirically by Beijing and Shanghai having the highest dominance scores (87.7 and 86.3, respectively) of the 177 cities in China's urban hierarchy. Beijing's and Shanghai's scores are similar, and they are very much above (about 42 points higher than) Guangzhou, the city with the third highest score, and substantially above the remaining 174 cities. Beijing and Shanghai are defined and characterized as national and international metropolises, although with different histories. Beijing has been known as China's art and culture center since the Ming Dynasty. Beijing reinforced its position by being the capital of China since 1949 and gained its economic significance due to the concentration of state owned enterprises, fully developed financial and service sectors (including higher education, information technology, wholesale and retail), and its convenient transportation system connecting it with the country and the outside world. The second most influential city in China, Shanghai, is an international trade and financial center. Shanghai has dominated China's economic and commercial activities since the eighteenth century.

The second category is "National Metropolitan Centers"; these have influence and dominance at the national level, just below that of Beijing and Shanghai. There are eight such cities; namely, Guangzhou, Chongqing, Shenzhen, Tianjin, Hangzhou, Chengdu, Wuhan, and Nanjing. Their composite z-scores range from 20.2 to 44.1. These cities lag slightly behind Shanghai and Beijing in terms of manufacturing, transportation and services, but stand far above the other major cities in China.

Table 13.6 Population size, composite index scores, and composite index rankings, 69 cities, United States, 2012

Name	Population (in 10,000)	Ranking	Index
Super metropolitan center			
New York-Northern New Jersey-Long Island	1892.3	1	81.62
National metropolitan centers			
Los Angeles-Long Beach-Santa Ana	1286.2	2	58.75
Chicago-Joliet-Naperville	946.1	3	33.12
Regional metropolitan centers			
Miami-Fort Lauderdale-Pompano Beach	559.8	4	18.27
Dallas-Fort Worth-Arlington	640.1	5	15.36
Houston-Sugar Land-Baytown	596.2	6	13.53
Philadelphia-Camden-Wilmington	596.7	7	12.80
Atlanta-Sandy Springs-Marietta	529.2	8	11.73
Boston-Cambridge-Quincy	456.4	9	9.65
San Francisco-Oakland-Fremont	434.9	10	8.23
Washington-Arlington-Alexandria	560.4	11	7.80
Sub-dominant regional metropolitan centers			
Detroit-Warren-Livonia	430.5	12	5.59
Minneapolis-St. Paul-Bloomington	329.1	13	5.02
Seattle-Tacoma-Bellevue	345.4	14	4.58
Phoenix-Mesa-Glendale	421.0	15	3.00
State Metropolitan Centers			
Riverside-San Bernardino-Ontario	423.4	16	1.08
Denver-Aurora-Broomfield	255.4	17	1.00
St. Louis	281.0	18	0.90
San Diego-Carlsbad-San Marcos	310.1	19	0.84
Urban centers with state influence			
Portland-Vancouver-Hillsboro	223.3	20	−0.16
Tampa-St. Petersburg-Clearwater	279.4	21	−0.33
Charlotte-Gastonia-Rock Hill	176.6	22	−1.20
Pittsburgh	235.8	23	−1.20
Baltimore-Towson	271.6	24	−1.49
Cleveland-Elyria-Mentor	207.5	25	−1.90
Urban centers with limited state influence			
Kansas City	203.5	26	−2.48
Orlando-Kissimmee-Sanford	214.8	27	−2.66
Cincinnati-Middletown	213.0	28	−2.69
Indianapolis-Carmel	176.0	29	−3.09
San Jose-Sunnyvale-Santa Clara	184.4	30	−3.71
Austin-Round Rock-San Marcos	173.2	31	−3.79
Columbus	184.0	32	−3.84
Milwaukee-Waukesha-West Allis	155.5	33	−4.01
Nashville-Davidson--Murfreesboro—Franklin	159.5	34	−4.33

(continued)

Table 13.6 (continued)

Name	Population (in 10,000)	Ranking	Index
Urban centers with limited sub-state influence			
Sacramento--Arden-Arcade—Roseville	215.4	35	−4.50
Providence-New Bedford-Fall River	160.1	36	−4.69
San Antonio-New Braunfels	214.9	37	−4.86
Las Vegas-Paradise	195.5	38	−5.10
Salt Lake City	112.7	39	−5.54
Oklahoma City	125.7	40	−5.80
New Orleans-Metairie-Kenner	116.6	41	−5.87
Louisville/Jefferson County	128.4	42	−5.94
Jacksonville	134.9	43	−5.95
Virginia Beach-Norfolk-Newport News	167.5	44	−6.01
Birmingham-Hoover	112.8	45	−6.12
Urban centers			
Hartford-West Hartford-East Hartford	121.1	46	−6.25
Richmond	126.0	47	−6.35
Bridgeport-Stamford-Norwalk	91.9	48	−6.68
Memphis	131.7	49	−6.70
Raleigh-Cary	113.5	50	−6.71
Tulsa	93.7	51	−6.86
Buffalo-Niagara Falls	113.5	52	−6.97
Grand Rapids	77.7	53	−7.15
Rochester	105.4	54	−7.23
Omaha-Council Bluffs	86.6	55	−7.52
Oxnard-Thousand Oaks-Ventura	82.3	56	−7.84
Worcester	79.9	57	−7.92
Columbia	76.7	58	−8.00
Baton Rouge	80.2	59	−8.09
Allentown-Bethlehem-Easton	82.1	60	−8.14
Albany-Schenectady-Troy	87.1	61	−8.15
New Haven-Milford	86.1	62	−8.16
Albuquerque	88.6	63	−8.25
Tucson	98.1	64	−8.49
Dayton	84.2	65	−8.59
Fresno	93.1	66	−8.79
El Paso	80.1	67	−8.89
Bakersfield-Delano	83.9	68	−9.19
McAllen-Edinburg-Mission	77.5	69	−9.46

Table 13.7 The urban hierarchy of China, 2012

Category	Number of cities	Percentage	Z score range
Super Metropolitan Centers	2	1.1	86.34 to 87.71
National Metropolitan Centers	8	4.5	20.24 to 44.12
Regional Metropolitan Centers	4	2.3	15.39 to 17.17
Sub-dominant Regional Metropolitan Centers	11	6.2	7.20 to 12.68
Provincial Metropolitan Centers	8	4.5	3.77 to 5.41
Urban Centers with Provincial Influence	10	5.7	0.17 to 3.00
Urban Centers with Limited Provincial Influence	44	24.9	−3.81 to −0.01
Urban Centers with Limited Sub-provincial Influence	31	17.5	−5.18 to −4.0
Urban Centers	59	33.3	−8.55 to −5.27
Total	**177**	**100%**	

The national metropolitan centers exert their national influence in the urban system in China through different mechanisms. Some national metropolitan centers benefit from their superior geographical locations. For example, Guangzhou is located at the mouth of the Zhujiang River, and it has been a trade center of China for centuries. In recent decades, due to its influential position in manufacturing and processing industry, in combination with its function in transportation as a port city, Guangzhou has become a major industrial, trade and commercial center in southern China.

Some national metropolitan centers benefit from both an advantageous geographic location and predominance in political regime. For instance, Tianjin, a northern port city, experienced tremendous development and growth since it was placed under the direct control of the central government in the late 1940s. Similar to Tianjin, Chongqing was designated as a centrally controlled city in 1997; it is a western manufacturing center with an advantageous geographic location connecting southwestern China and central China in the upstream Yangtze River. Shenzhen is a major city in southern China, located just north of Hong Kong, but it used to be a small fishing village until becoming China's first Special Economic Zone in late 1979. Shenzhen now serves as a major financial center in China; it is home to the Shenzhen Stock Exchange, second only in China to the Stock Exchange in Shanghai. Shenzhen is also the headquarters of many commercial banks, insurance companies, and high-tech companies, and is one of the busiest ports in China. It is the largest migrant city in China, with more internal migrants than local residents.

The rest of the national metropolitan centers are capital cities of provinces located in different parts of China. Hangzhou is the capital city of Zhejiang province in eastern China. It is a major industrial and trade center in eastern China; it became prominent centuries ago as the southern terminus of the Grand Canal.

Chengdu is in Sichuan province in southwestern China. In ancient China, Sichuan enjoyed the reputation of being the "Heavenly Land of Plenty" because of its fertile cropland. Chengdu is the major industrial, commercial and transit city in the Xinan (Southwest) region. Its influence and control lie far beyond the provincial borders of Sichuan.

Wuhan is the capital city of Hubei province. It is known for its steel production and heavy industry, and for its key role as a river port city linking the East and the West via the Yangtze River, and the North and the South via China's major railroad lines.

Nanjing is located in the heartland of the Yangtze Delta area. It has long been a key center of government, education, research, and tourism. Nanjing was the capital of several Chinese dynasties and kingdoms.

The third category is "Regional Metropolitan Centers"; these are cities that exert dominance across provincial boundaries, but do not have the overarching influence and control as do Shanghai, Beijing, and the eight National Metropolitan Centers. There are four cities in this category: Xi'an, Shenyang, Foshan and Suzhou. Their composite z-scores range from 15.4 to 17.2. Two of them are provincial capitals, Xi'an (Shaanxi Province) and Shenyang (Liaoning Province), pointing to an interesting fact that many cities are not capitals but still can possess an appreciable amount of provincial level influence due to economic development.

The fourth category of cities in China's urban hierarchy is "Sub-dominant Regional Metropolitan Centers"; cities in this category have influence and control across provincial boundaries but are not as influential as the Regional Metropolitan Centers. There are eleven cities in this category. Their composite z-scores range from 7.2 to 12.7. Six of them are provincial capitals: Jinan is the capital of Shandong Province, Zhenghou of Henan Province, Hefei of Anhui Province, Harbin of Heilongjiang Province, Kunming of Yunnan Province, and Changsha of Hunan Province.

The fifth category is "Provincial Metropolitan Centers"; cities in this category have predominant influence and control pretty much confined within their provincial boundaries. There are eight cities in this category. Their composite z-scores range from 3.8 to 5.4. Five of them are the capitals of their respective provinces: Fuzhou is the capital of Fujian Province, Nanning of the Guangxi Autonomous Region, Taiyuan of Shanxi Province, Shijiazhuang of Hebei Province, and Changchun of Jilin Province.

The sixth category is "Urban Centers with Provincial Influence." The cities in this category have influence and control within their provincial boundaries but are not as predominant as the Provincial Metropolitan Centers. There are ten cities in this category, with composite z-scores ranging from 0.2 to 3.0. Only two of the cities in this group are provincial capitals, namely, Nanchang, the capital of Jiangxi Province, and Urumqi, the capital of the Xinjiang Autonomous Region.

The seventh category is defined as "Urban Centers with Limited Provincial Influence," indicating that cities in this category have very limited provincial influence, and less influence than that of the Urban Centers with Provincial Influence.

There are 44 cities in this category, accounting for one-quarter of all the cities in China's urban hierarchy. Their composite z-scores range from −3.8 to −0.1.

The eighth category is defined as "Urban Centers with Limited Sub-provincial Influence." Their composite z-scores range from −5.2 to −4.0. Cities in this category have influence mainly at the precinct level or influence across or within counties. There are 31 cities in this category.

The ninth and final category is defined as "Urban Centers," indicating that cities in this category have little if any influence over the other cities. They are large in population (more than 750,000), but their spheres of ecological dominance and control are restricted to their adjacent areas and seldom beyond their adjacent towns and hinterlands. There are 59 cities in this category, covering one-third of all the cities in the hierarchy. Their composite z-scores range from −8.6 to −5.3.

Among the cities in the last three categories, a few of them are provincial capitals. The three provincial capitals of Guiyang (Guizhou Province), Hohhot (the Inner Mongolia Autonomous Region) and Lanzhou (Gansu Province) are among the cities in the seventh category, Urban Centers with Limited Provincial Influence. Yinchuan, the capital of Ningxia Hui Autonomous Region is one of the cities in the eighth category, Urban Centers with Limited Sub-provincial Influence. And Xining, the capital of Qinghai Province in the western China, is one of the cities in the ninth category, Urban Centers. This suggests that being a capital city does not automatically mean that a city will be a dominant urban center.

Based on the observations and discussions above, the development of cities in their dominance and control in China's urban hierarchy is closely associated with the level of economic development, the resources owing to geographic location, political influence and cultural foundation. In particular, although being a capital city means the city has an important administrative and political position, at least within the province, a provincial capital city in a less developed province is usually in a lower position in the urban hierarchy than a non-capital city in a more developed province. For example, Dongguan, a Subdominant Regional Metropolitan Center in Guangdong Province, is shown to have more urban influence than many capital cities in middle China, e.g., Hefei, Harbin, Changsha, Fuzhou, Taiyuan, and other provincial capitals in the western China, e.g. Kunming, Lanzhou, Urumuqi, Hohhot and Yinchuan. As such, it is clear that in a large and diverse developing country like China, the political and administrative structure can be very different from the urban hierarchical structure.

We now turn to a discussion of the urban system in the United States. Table 13.6 lists dominance z-scores for each of the 69 cities. Table 13.8 summarizes the results of our analysis of the 69 U.S. cities with populations of 750 thousand or more in 2012 according to the values of their metropolitan dominance scores.

New York City is America's only "Super Metropolitan Center." Our data show that New York has overwhelming influence and dominance over all the cities of the U.S., as indicated by its very large composite z-score of 81.6, easily the highest score of any other U.S. city. New York clearly stands above the next ranked cities of Los Angeles and Chicago, and considerably above the remaining 66 U.S. cities.

Table 13.8 The urban hierarchy of the United States, 2012

Category	Number of cities	Percentage	Z score range
Super Metropolitan Centers	1	1.4	81.62
National Metropolitan Centers	2	2.9	33.12 to 58.75
Regional Metropolitan Centers	8	11.6	7.80 to 18.27
Sub-dominant Regional Metropolitan Centers	4	5.8	3.00 to 5.59
State Metropolitan Centers	4	5.8	0.84 to 1.08
Urban Centers with State Influence	6	8.7	−1.90 to −0.16
Urban Centers with Limited State Influence	9	13.0	−4.33 to −2.48
Urban Centers with Limited Sub-State Influence	11	15.9	−6.12 to −4.50
Urban Centers	24	34.8	−9.46 to −6.25
Total	**69**	**100%**	

The development of New York began with commercial activities in the early seventeenth century (Lankevich 2002; Burrows and Wallace 1999). Benefiting from its strategic location as a vital port, since the nineteenth century New York received millions of new immigrants from southern and eastern Europe. New York controlled America's cotton trade with European manufacturers. New York City also benefited greatly from the construction of the Erie Canal, which extended its hinterland into the major Northeastern cities. By 1900, 69 of America's 100 largest corporations were headquartered in New York. In the 1990s, the focus of New York's economy started to move from manufacturing to services, with The Wall Street boom as an example. "Wall Street remained the epicenter of American capitalism, a true icon of the most success-driven society on the planet" (Lankevich 2002: 230). New York was home to over 200 commercial banks, 82 savings institutions, and hundreds of brokerage firms servicing investors all over the world by early twenty-first century. The 2000 Census showed that for the first time New York City was a population of more than 8 million, with 40% of its people foreign-born. New York is arguably one of the grandest creations of urban society in the world with its libraries, parklands, museums, opera house and theaters, churches, and skyscrapers, and most importantly, the cosmopolitan and heterogeneous culture.

Los Angeles and Chicago are "National Metropolitan Centers." Their composite z-scores are 58.8 and 33.1. Although ranking behind New York, these two cities stand far and above the other major U.S. cities. Los Angeles is located on the west coast and Chicago in the upper Midwest.

The "Regional Metropolitan Centers" in the U.S. are Miami, Dallas, Houston, Philadelphia, Atlanta, Boston, San Francisco, and Washington, DC. Their composite z-scores range from 7.8 (Washington, DC) to 18.3 (Miami). The "Subdominant Regional Metropolitan Centers" are Phoenix and Seattle (located in the west) and Detroit and Minneapolis (in the Midwest), with their composite z-scores ranging from 3.0 (Phoenix) to 5.6 (Detroit).

The "State Metropolitan Centers" are Riverside, Denver, St. Louis and San Diego. The composite z-scores of these four cities range from 0.8 to 1.1.

There are six cities defined as "Urban Centers with State Influence"; their composite z-scores range from −1.9 (Cleveland) to −0.2 (Portland). This group is followed by nine cities in the category of "Urban Centers with Limited State Influence" (z-scores from a low of −4.3 (Nashville) to a high of −2.5 (Kansas City).

The next group, "Urban Centers with Limited Sub-state Influence" has eleven cities with z-scores from −6.1 (Birmingham) to −4.5 (Sacramento). Finally, there are 24 cities categorized as "Urban Centers," with z-scores from −9.5 (McAllen) to −6.3 (Hartford).

It is of interest to compare the hierarchical locations of the capital cities of the U.S. with those of China. In the U.S., the influential cities are usually not capital cities, but cities with advantageous geographic location, while in China more capital cities are gaining national influential influences. Take Washington, D.C. and Beijing as examples. Both are the headquarters of the two nations, but Washington, D.C. does not have anywhere near the metropolitan dominance of Beijing. Beijing is one of China's two Super Metropolitan Centers, while Washington, DC is merely a Regional Metropolitan Center, with the 11th highest dominance score of all the major U.S. cities. This difference is related in part to political arrangements. The key function of Washington, D.C. is merely government service, but Beijing is not only the center of government service in China, but is also dominant in the cultural, financial, and transportation areas.

13.5 Conclusion

This chapter has examined the patterns of dominance and sub dominance of the largest cities with populations of 750 thousand or more in China and the United States in 2012. There are 177 such cities in China and 69 in the U.S. Following the perspective of human ecology, we analyzed the dominance and control of cities over other cities. We followed the research of Vance and Sutker (1957) and others that noted that the designation of a city as a metropolis should look beyond the size of its population and focus on its organizational control and integration. Although population size and administrative role are often assumed to be surrogate or proxy indicators for the ranking of cities, the empirical urban dominance ranking by a composite score of selected functional indicators can be quite different.

The results in this chapter provide similar pictures of the urban hierarchies in China and the U.S. with nine levels. The results indicate the tremendously influential position of Beijing and Shanghai among the big cities of China, and New York among the big cities of the U.S. All three cities are Super Metropolises, comparable in influence to London, Paris and Tokyo and other Super Metropolises in the world. In addition, our investigations also demonstrated that the delineated spheres of ecological influence and control surprisingly transcend the political and administrative boundaries in the two countries. Cities gain dominance through geographical advantages, economic development, and cultural and historical traditions. Our approach therefore adds to the knowledge of urban hierarchies by considering the actual ecological and other mechanisms involved in the processes whereby cities become dominant over other cities.

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Chapter 14
School District Formation as an Explanation for Spatial and Temporal Dimensions of Concentrated Poverty in Bexar County, Texas

Matthew J. Martinez

14.1 Introduction

Recent political debates in Texas have focused on school district consolidation and the economic impacts of this potential change (Boser 2013; Cooley and Floyd 2013; Taylor et al. 2014). Early indications are that such wide-scale consolidations across the state are not economically viable mainly because they do not save school districts money. While financial considerations are important to the discussion, they should not be the sole determining factor. In this chapter I extend the scope of the discussion and consider the social impacts of school district fragmentation. Using a socio-historical analysis of Bexar County, Texas I do the following: (1) consider how school district formation in the county reified persistent concentrated neighborhood poverty; and (2) due to this mechanism, I consider how school district consolidation should be considered within the framework of ending cycles of persistently concentrated neighborhood poverty. Bexar County demonstrates well the importance for considering the social impact of potential school district consolidation. The county has a history of place-based educational and economic disparities found between school districts (Drennon 2006), as evidenced early on in the Supreme Court decision of *San Antonio ISD v. Rodriguez* (1973).

I argue throughout this chapter that certain neighborhoods in Bexar County have developed persistent patterns of high poverty due to school district formation processes. The first component was the formation of common school districts (CSDs) around racially and economically segregated neighborhoods (Drennon 2006). Considering that housing options were available only to individuals from certain racial and economic backgrounds (Drennon 2006), these CSDs took on the attribute of being racially and economically segregated themselves. As these neighborhoods grew, the CSDs were consolidated into the independent school districts (ISDs) that

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currently serve Bexar County. Residential segregation alone may not have been as disastrous to neighborhood poverty if it were not for the second component which sanctioned property taxes as a partial source of school district funding. This relationship allowed schools in property rich neighborhoods to excel while schools in property poor neighborhoods struggled to properly educate students (Soltero 2006). Given theories on how neighborhood desirability and collective mobility patterns are tied to neighborhood change (Jargowsky 2014; Sampson 2012; Sharkey 2013; Taub et al. 1984), these initial conditions have created cycles of concentrated poverty and concentrated high dropout rates.

Before making these links more apparent, I will briefly describe the historic context of poverty for Bexar County and the city of San Antonio. This will allow for a more nuanced understanding of my argument linking school district formation to contemporary concentrated neighborhood poverty and concentrated high dropout rates. The historical context of Bexar County is established by looking at San Antonio directly, due to the fact that much of the county's formation is tied to the economic and population growth of the city. San Antonio's Westside and Eastside, which are historically Hispanic and Black communities respectively, will be of special interest throughout this discussion due to the extreme concentrated poverty in these areas (Bauder 2001; Bauder and Sharpe 2000; Clayson 2002; de Oliver 2001; Drennon 2006; Telles and Ortiz 2008). Temporally, the decades following HemisFair 68' (1970–2010) is of special interest because this world's fair was thought to be the catalyst for economic growth and subsequent declines in poverty for the area (de Oliver 2001; Medina 2010).

14.2 Neighborhood Poverty in Bexar County

14.2.1 Historic Context

During the 1930s when the Public Works Administration was surveying San Antonio, administrators described the Westside as a place of extensive slums which rivaled any found in other American cities (Drennon 2006). Clayson (2002) noted that there were homes without running water, outdoor toilets and unpaved streets with many homes aesthetically similar to rural shacks. The conditions observed in the 1930s remained as evidenced in a CBS News documentary in 1968 which featured the Westside as emblematic of the problem of poverty and hunger in the United States (Carr et al. 1968). The political strife these conditions caused was noted during the World's Fair (aka HemisFair 68') when a couple thousand citizens from a local youth organization marched in protest to City Hall in order to voice their lack of participation in policy decisions made during the War on Poverty (Clayson 2002). Westside and Eastside poverty did not end after these protests or documentaries, but as will be shown throughout this chapter, it continues today. Why have there been pockets of persistent poverty in Bexar County, particularly in

San Antonio's Westside and Eastside neighborhoods? Also, what are the mechanisms that first created these pockets and how are they maintained? It is critical to examine neighborhood and school segregation in Bexar County as potential mechanisms for both the creation and maintenance of persistent neighborhood poverty in this urban setting.

14.2.2 Neighborhood and School Segregation as Reinforcing Mechanisms for Bexar County Poverty

Education, as is well documented, plays an important role in the future life chances of people (Olneck and Kim 1989; Ou 2008; Stoll 2010; Warren et al. 2008). Limited resources make it more difficult for students to learn the necessary skills that prepare them for the labor market (Deil-Amen and DeLuca 2010; Greenwald et al. 1996; Perry and McConney 2010). Not only does educational attainment or a lack thereof play a role in future individual economic health (Ainsworth 2002; Murnane et al. 2001), it also has lasting effects on areal earnings and labor market outcomes. The long term effects on labor market outcomes are due in part to social and spatial mobility, as minorities, compared to whites, are less likely to move out of their neighborhoods and less likely to improve their environments if they do move (Harding 2003). Based on this logic, neighborhoods initially lacking adequate resources to educate their residents then become self-producing systems of disadvantage due to a lack of skills and mobility. In Bexar County, Texas, this initial allocation was based on racial and economic segregation.

Some Bexar County neighborhoods were developed in racially segregated ways with neighborhoods being designated as Anglo only, Mexican only, Black only, or some combination thereof (Drennon 2006). Not only were there *de jure* and *de facto* racial restrictions on renting and buying homes, income based segregation was also practiced in the early 1900s (Drennon 2006). Economic and racial residential neighborhood segregation in Bexar County was effectively transferred into school segregation through the development of independent school districts (ISD). School districts first began as common school districts (CSD) based on the neighborhoods in which they were located. Once community districts began to consolidate into larger independent bodies, the ISDs naturally had the same demographic makeup as the economically and racially segregated areas that formed them (Drennon 2006). With school district funding associated with property taxes, schools located in poorer neighborhoods could not gather the same amount of resources as could schools located in wealthier neighborhoods; resource inequality in schools was the result.

The potential negative consequences of school funding being tied to racially and economically segregated neighborhoods were not lost on the citizenry. In fact, some communities in Bexar County insolated themselves from being enveloped by San Antonio ISD by forming separate municipalities, thus creating a path to insulate the wealth of income and resources within their boundaries (Drennon 2006). During the formation of Edgewood ISD, which serves some of the Westside neighborhoods, leaders voiced their opposition to a separate district apart from San Antonio ISD due to the low income tax base (Drennon 2006). Edgewood ISD, at that time, had the lowest tax base even though it taxed its residents at a higher rate than the prestigious and municipally separate Alamo Heights ISD. This inequality culminated in the Supreme Court case of San Antonio ISD v. Rodriguez in 1973 in which the court found that poverty is not a suspect class to be protected by the Fourteenth Amendment's Equal Protection Clause. Furthermore, they ruled that education was not a fundamental right protected by the Constitution. This ruling codified the continuation of educational resource disparities between districts.

School district funding policies, although not explicitly racially biased, had, and still have, the effect of benefiting whites over other minority groups in the county. Considering that blacks and Mexicans never had a chance to move into predominately white neighborhoods due to racial and economic restrictions, they also were not able to benefit from the greater availability of school resources in wealthier neighborhoods. Wealth acquisition and accumulation occurred in white neighborhoods but not minority ones (Drennon 2006). This was concomitantly due to racial bias in how the presence of minorities negatively affects housing values (Crowder 2000; Harris 1999) and how school funding is tied to these housing values. Therefore, residents in wealthy white neighborhoods were more equipped to fund their CSDs, and later ISDs, than residents in poorer more minority neighborhoods. After consolidation occurred to form the larger independent school districts in the county, a system of wealth acquisition and accumulation was set in place. Wealthy predominately white school districts and neighborhoods would have cumulative advantages over poorer predominately minority school districts and neighborhoods. This structural racism continues in Bexar County today, and the effects of these cumulative disadvantages can be seen in outcomes such as persistent neighborhood poverty and concentrated high dropout rates.

14.3 Explanations of Neighborhood Poverty: Review of Literature

Taub et al. (1984) have developed a general theory of neighborhood change that includes (1) the ecological facts of the neighborhood; (2) decisions made by corporations or institutions to invest in the neighborhood; and (3) individuals' independent actions, which contribute to collective patterns of neighborhood stability/change. The mechanisms work in a symbiotic fashion towards neighborhood change as one mechanism affects the other. For example, changes in the ecological facts of a neighborhood may spur corporate investment, or corporate investment may spur changes in the ecological facts. This theory provides a good framework for considering potential factors leading to change in neighborhood poverty over time in Bexar County.

Ecological facts about a neighborhood include job market factors; the condition of the housing market, including age and the quality of housing; and available neighborhood amenities. Explanations of individual poverty revolve around labor market structure as seen through mechanisms like spatial mismatch (Bauder and Sharpe 2000; Stoll 1999, 2000). Theories in spatial mismatch effectively state that a cause of poverty stems from an individual's skills not fitting with available jobs. If enough individuals in an area experience this type of mismatch, then it may create a cycle of joblessness and higher poverty. A solution to neighborhood poverty thus includes appropriate job creation within depressed areas (Danziger and Gottschalk 1995). With that said, some macro-level analyses have found limited support of public jobs leading to declines in poverty (Brady 2009). Given this body of research, I will include controls for the labor market in my empirical analyses presented later.

Investment by social institutions and corporations can occur through the building of schools, repair/creation of transportation infrastructure, building or remodeling stores within the neighborhood, etc. (Taub et al. 1984). These institutional and corporate decisions may be perceived by individuals in neighborhoods and facilitate individual investment. Individual actions to invest into or withdraw from a neighborhood may also be driven by perceptions of safety (Sampson 2012), hopes of future institutional/corporate investment, and changes in the ecological facts of the neighborhood (Taub et al. 1984; White and Lindstrom 2005). Homeownership and home quality can be thought of as a component of individual and institutional investments in neighborhoods because homeownership has been found to affect investment in the property as well as tenure of neighborhoods (Rohe and Stewart 1996).

Individual actions to migrate to and from neighborhoods may also lead to changes in neighborhood poverty, as the introduction of higher income individuals/families would lower the poverty rate and outmigration of higher income individual/families would raise the poverty rate, all else equal. Choices to migrate may be driven by a number of factors including the ecological facts of a neighborhood, the corporate/individual investment in a neighborhood, and the general desirability of a neighborhood. Neighborhood desirability can be influenced by such factors as neighborhood racial and educational composition (Crowder 2000; Harris 1999; Schwab 1987). Considering this relationship, controls for racial and educational composition will be included in my empirical models presented later.

Population change is measured in order to test the influence of migration into and out of neighborhoods on changes in neighborhood poverty. It is important to note that, although neighborhood population change will be used, this measure does not separate changes due to births/deaths from changes due to migration, nor can I measure reasons for migration. Considering past micro and macro theories of poverty (Brady 2009; Iceland 2006; Wilson 2012), a proxy of family structure will be included in the empirical analyses to both replicate other studies and to control for how family structure potentially affects neighborhood poverty.

In addition to the covariates just presented that are potentially correlated with neighborhood poverty, I offer an additional mechanism, which is tied to persistently high dropout rates. I use the term "dropout legacy" to describe neighborhoods that have the attribute of having persistently high dropout rates. In urban contexts, dropout legacy may be tied to a variety of socio-political mechanisms. In Bexar County, dropout legacy is tied to the structure of neighborhood and school district formation. Given the role of residential segregation in the formation of Bexar County neighborhoods and the link between school funding and property taxes, neighborhoods initially lacking adequate resources to educate their residents (i.e. Westside and Eastside neighborhoods) then become self-producing systems of disadvantage. These self-producing systems become reified due to: (1) the relationship between socioeconomic status and mobility patterns into poor neighborhoods (South and Crowder 1997); and (2) the out-migration of higher educated role models leave children with fewer neighborhood role models to emulate (Ainsworth 2002; Saenz and Siordia 2012). I argue that the consequences of historic neighborhood segregation as measured by persistently high dropout rates (i.e. dropout legacy) serve as the strongest predictor of neighborhood poverty in the area from 1980 to 2010, all else equal. Considering the structure of residential segregation in Bexar County, I also hypothesize that the Westside and Eastside neighborhoods will have stronger correlations with poverty compared to all other census tracts in the county.

14.4 Data and Methods

The data I use in the analyses to be presented in this chapter are from the Neighborhood Change Database (GeoLytics 2013), which standardizes U.S. census data from 1970, 1980, 1990, 2000, and 2010 to 2010 census tract boundaries. The Neighborhood Change Database (NCDB) allows for demographic changes to be modeled within a constant area of interest. Census tracts are used because they are proxies for local neighborhoods (Crowder and South 2011; Stoll et al. 2000) and, given the data, they best approximate the local neighborhoods. The dependent variable used in this analysis is the percent poverty of a neighborhood measured from 1980 through 2010 at decennial time points. The dependent variable has been lagged so that 1980 poverty is explained by 1970 covariates. Percent poverty is measured as the proportion of persons in poverty for whom poverty status is determined, multiplied by 100. Poverty status is based on varying thresholds for different household size and income compositions; this is a measure of poverty consistent with previous research (Poston et al. 2010).

In line with theories of neighborhood change discussed above, I included controls for the following time-varying independent variables: the homeownership rate, the age and quality of housing, the proportion employed, the proportion single-mother headed households, the proportion with a college degree or higher, the proportion Hispanic, and neighborhood population change. The independent variables of interest include the dropout rate in the neighborhood, dummy variables capturing Westside and Eastside neighborhoods in San Antonio, and a dummy variable for whether a neighborhood is classified as having persistently high dropout rates (i.e., the dropout legacy variable). All continuous independent variables have been standardized to have a mean of zero and a standard deviation of 1.

The homeownership rate is calculated following the calculations presented by Rohe and Stewart (1996); it is the number of owner-occupied housing units plus the number of vacant units for sale divided by the number of total occupied housing units and the total vacant units for sale or rent. Age and quality of housing are linked to the ecological facts of neighborhoods and are calculated for each census year by the number of houses 20 years and over (henceforth called “foundation homes”) in the neighborhood divided by the total number of housing units in the area. Also tied to ecological facts about a neighborhood is the neighborhood labor market. The proxy for labor market is the proportion of the civilian population 16+ employed in the neighborhood divided by the population 16 and over. The proportion of single-mother headed households measures how many households are composed of single-mothers with their own children present in the home and no husband present. It should be noted that this variable does not capture cohabitation practices, as these types of relationships may add resources into the household that otherwise would not be present. The proportion bachelor’s degree or higher is calculated for individuals over the age of 25 with at least a bachelor’s degree. The proportion Hispanic measures the number of Hispanic residents in each census tract by the total number of residents in the tract. The inclusion of this variable allows the effects of racial composition to be seen in an urban center that, for most of the years in these analyses, is comprised of a minority-majority population (i.e. Hispanics are numerically the largest racial/ethnic group). Population change is the percent change from one census year to the next which is calculated as: $((\text{Census Year}_{x+1} - \text{Census Year}_{x})/\text{Census Year}_{x}) * 100$.

14.4.1 Independent Variables of Interest

The proportion dropout is measured by the number of individuals 25 years and over who did not complete the 12th grade or receive an equivalency degree in relation to individuals 25 years and over who at least completed high school or received a GED. An important caveat to the measurement of this variable is that given research on the similarities in characteristics between GED recipients and high school non-completers (Ou 2008), the inclusion of individuals with GEDs in the completer category may be deflating the actual number of high school non-completers. In models including the dropout rate, I also control for Westside and Eastside neighborhoods. Two dummy variables are used to capture residence in these areas based on the boundaries laid out by the respective organizations representing each area (Eastside Promise Neighborhood 2013; Westside Development Corporation 2012). In separate models not including the dropout rate or controls for the Westside and Eastside neighborhoods, I include a dichotomous variable measuring neighborhoods categorized as having a dropout legacy. The decision to drop Westside and Eastside dummy variables in this model is due to the fact that most Westside and Eastside tracts are also tracts with a dropout legacy (see Fig. 14.1). Figure 14.1 below shows current school district boundaries including where dropout legacy census tracts are

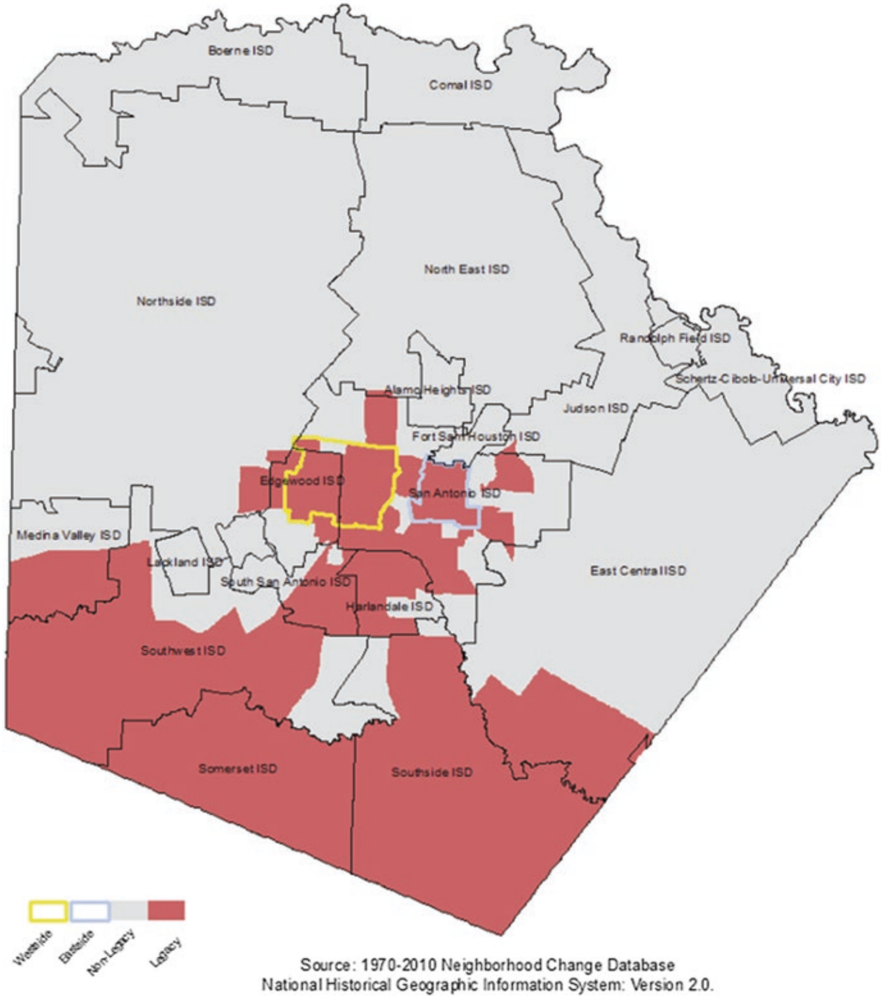

Fig. 14.1 Dropout legacy tracts by school district in Bexar County, Texas

within these district boundaries and the Westside and Eastside neighborhood boundaries. A census tract is considered to have a dropout legacy if it is in the top quartile of dropout rate distributions in at least 75%[1] of census years from 1970 to 2010. It

[1] Other operationalizations were used to define legacy neighborhoods including using: tracts that are in the top quartile in all census years from 1970-2010; tracts that were consistently one standard deviation above the mean dropout rate in all census years from 1970 to 2010 – yet results are similar as dropout legacy neighborhoods in Bexar County remain the same regardless of how legacy is operationalized.

is important to note that tracts with persistently high dropout rates are calculated at the national, not local level. Measuring dropout legacy nationally allows Bexar County dropout rates to be contextualized within larger national, historic patterns.

14.4.2 *Analytic Strategy*

In my analyses I first present descriptive statistics for all the dependent and independent variables for Bexar County. Bexar County is chosen over San Antonio city limits due to the inclusion of municipalities like Alamo Heights, which are embedded within the larger city boundaries. By excluding some municipalities in a larger metropolitan area, the effects of these types of separations may be missed.

First, exploratory data analyses are carried out to gain an understanding of the spatial distribution of poverty in Bexar County from 1970 to 2010, specifically as it pertains to the Westside and Eastside areas. This is followed by a multivariate analysis explaining poverty in Bexar County over time. Given the time-varying nature of the dependent and independent variables, multilevel models for change are used (Singer and Willett 2003). Time-varying predictors are modeled as level-1 variables, and time-invariant predictors (Westside/Eastside & Dropout Legacy) are modeled as level-2 predictors, with appropriate variance components added for the level-2 predictors. All time-varying predictors are standardized with a mean of zero and a standard deviation of 1 for ease of interpretation. Maximum likelihood estimation is used to determine the coefficients. Also, the models include a random intercept and random slope (time), which shows how poverty rates have increased or decreased over time. The statistical models used to answer this research aim take the following form:

$$Y_{ij} = \pi_{0i} + \pi_{1i}\text{Time}_{ij} + \pi_{(n+1)i}\text{Time Varying Predictors}_{ij} + \pi_{(n+1)i}\text{Time Invariant Predictors}_{i} + \varepsilon_{ij}$$

$$\pi_{0i} = \gamma_{00} + \delta_{0i}$$

$$\pi_{1i} = \gamma_{10} + \delta_{1i}$$

$$\pi_{(n+1)i} = \gamma_{(n+1)0}$$

$$\vdots$$

$$\pi_{(n+1)i} = \gamma_{(n+1)0} + \delta_{(n+1)i}$$

$$\vdots \, .$$

The exploratory analyses will focus on Bexar County poverty from 1970 to 2010, and the empirical analysis will focus on poverty in the county from 1980 to 2010 due to the lagged dependent variable.

14.5 Results

In analyzing the spatial distribution of poverty over time in Bexar County, Fig. 14.2 shows areas of persistent poverty from 1970 to 2010. The categories included are: (1) less than 10%; (2) 10–19.99%; (3) 20–29.99%; (4) 30–39.99%; and (5) greater than 40%. Poverty is categorized in this way due to past literature on high-poverty neighborhoods and the various cut-off points (i.e. 20%, 30%, 40%) used to consider an area a high-poverty area (Galster et al. 2003; Jargowsky 1997; Wilson 2012). Looking at the maps in Fig. 14.2, we see a concentration of high poverty census tracts within the city's Westside and Eastside boundaries. As is shown in Fig. 14.2, the Westside and Eastside have remained in high poverty, with most of the census tracts in these areas remaining above 20% poverty throughout the period of 1970–2010. The maps show that in 2010, the city had less extremely high poverty areas (40% or more) than other years. Also in 2010, there appears to be more spread of the highest poverty areas, including two tracts by Loop 1604 and Interstate 10

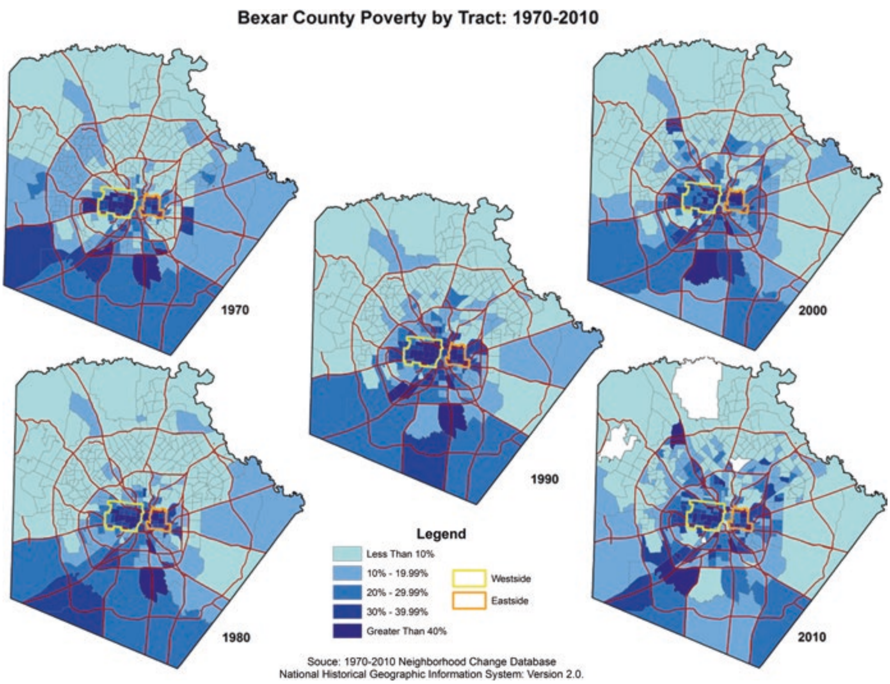

Fig. 14.2 Bexar county, Texas poverty rates by tract from 1970 to 2010

which house the county's major university, The University of Texas at San Antonio. Yet the concentration of these high poverty areas remains mostly constrained to neighborhoods in the Westside and Eastside areas.

Another measure of the temporal and spatial clustering of poverty in Bexar County is seen by the results in Fig. 14.3. Figure 14.3 displays a scatterplot of 1970 standardized poverty rates and 2010 standardized poverty rates within census tracts. Westside tracts are denoted with an x, and census tracts in the Eastside are denoted by a triangle; all the other census tracts are symbolized as circles. This plot shows a high correlation ($R = 0.54$, $p < 0.001$) between 1970 and 2010 poverty rates in Bexar County showing the relative stability of the spatial distribution of poverty over time. The plot is divided into four quadrants with the upper left representing tracts that had average or below average poverty in 1970 and above average poverty in 2010. Two Westside tracts reside in this upper left quadrant. The upper right quadrant represents neighborhoods with above average poverty in 1970 and 2010 – these neighborhoods could be defined as having stable high poverty. A majority of neighborhoods with stable high poverty are located in the Westside and Eastside of San Antonio – only two Eastside tracts are in a different quadrant. The third quadrant in the bottom left contains neighborhoods with stable average or low poverty. A majority of non-Westside and non-Eastside neighborhoods reside in this quadrant with five Westside tracts located in this quadrant. The fourth quadrant, located in the bottom right of the graph, is characterized by decreasing poverty, where tracts had above average poverty in 1970 and have average or below average poverty in 2010.

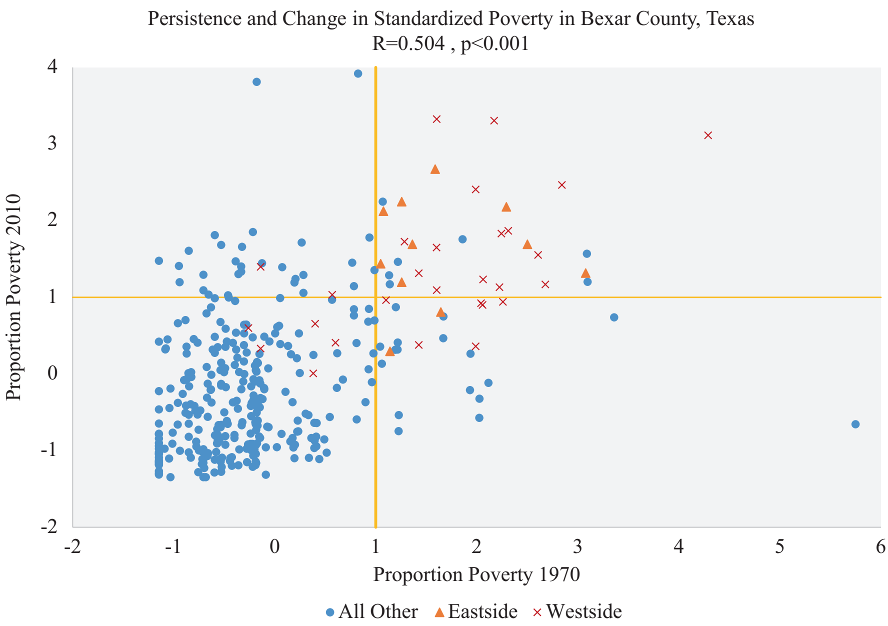

Fig. 14.3 Persistence in change in poverty rates in Bexar county, Texas

Six Westside tracts are in this quadrant with four residing near above average 2010 poverty, while two Eastside tracts are in this quadrant. Taken together results displayed in Figs. 14.2 and 14.3 show that the Westside and Eastside have historically had the highest poverty rates in San Antonio with high poverty being mostly stable from 1970 to 2010. Next, possible factors for these spatial associations are explored (Fig. 14.4).

Table 14.1 presents descriptive statistics of all the independent variables and the dependent variable stratified by Westside/Eastside neighborhoods and all other neighborhoods for 1970 and for 2010, including percent change from 1970 to 2010. Average population counts are displayed instead of average population change because the counts give a more clear representation of population growth in Bexar County over the years. Figure 14.4 is a graphical representation of the means of the variables used in the analyses (excluding the population change variable) for each census year from 1970 to 2010 for the Westside and Eastside neighborhood. As is shown in Table 14.1, there is relatively little difference between 1970 and 2010 poverty for Westside and Eastside neighborhoods. On the other hand, poverty rose 25% from 1970 to 2010 for all census tracts not in these neighborhoods, although this rise in poverty is still under both Westside and Eastside 2010 poverty rates. Figure 14.4 shows how poverty had peaks and troughs throughout the five decades in this analysis, with 2010 poverty rates returning to 1970 levels. Also of note is the sharp decline in all areas in the neighborhood dropout rate. This is not too surprising seeing that it corresponds to national trends of dropout rates (Chapman et al. 2011).

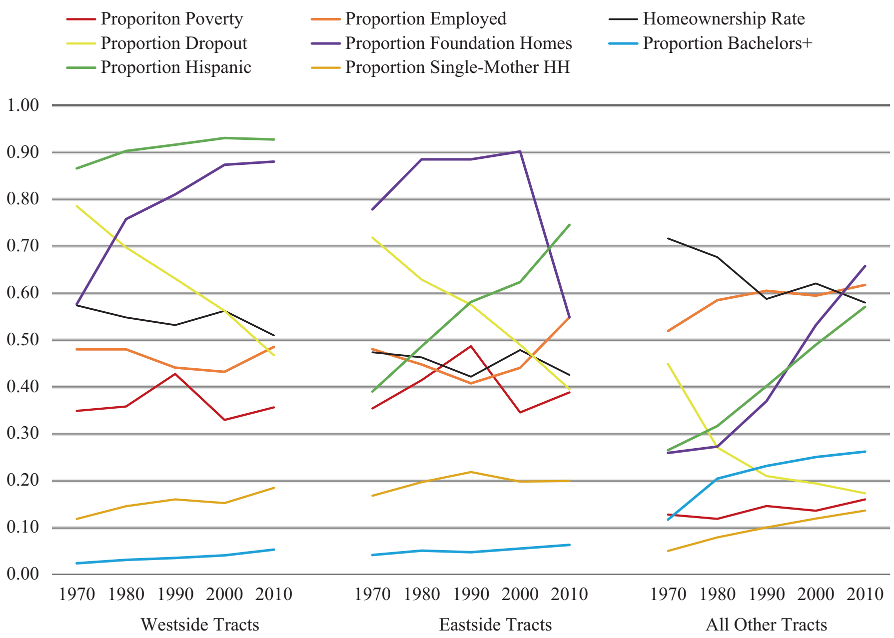

Fig. 14.4 Time-variant predictors by census tract locations from 1970 to 2010

Table 14.1 Means for census tracts in the westside, eastside and all other census tracts for 1970, 2010, and percent change

Variables	Westside tracts			Eastside tracts			All other tracts		
	1970	2010	Percent change	1970	2010	Percent change	1970	2010	Percent change
Proporiton Poverty	0.35	0.36	2.16	0.35	0.39	9.71	0.13	0.16	25.50
Homeowner ship Rate	0.57	0.51	−11.18	0.47	0.42	−10.22	0.72	0.58	−19.15
Proportion Foundation Homes	0.58	0.88	52.83	0.78	0.55	−29.58	0.26	0.66	154.55
Proportion Employed	0.48	0.48	1.10	0.48	0.55	14.20	0.52	0.62	18.95
Proportion Single-Mother HH	0.12	0.18	56.73	0.17	0.20	18.95	0.05	0.14	175.51
Proportion Bachelors+	0.02	0.05	129.02	0.04	0.06	53.58	0.12	0.26	125.00
Proportion Hispanic	0.87	0.93	7.12	0.39	0.74	91.27	0.26	0.57	115.91
Proportion Dropout	0.78	0.47	−40.57	0.72	0.39	−45.02	0.45	0.17	−61.61
Population Count	5695	4222	−25.86	4653	3167	−31.94	2002	4814	140.46
N	28			11			308		

Data from 2010 neighborhood change database

What is important, though, is the fact that even in 2010, over 2/5ths of the Westside and Eastside residents did not have a high school diploma or equivalent, whereas only 17% of the residents in all other neighborhoods did not have a high school diploma or equivalent. Lastly, I highlight that the proportion of Hispanic residents in the Westside has remained steady, while large increases in Hispanic residents is seen in the Eastside (91% increase) and all other areas (~116% increase) with Hispanics comprising over half of the population in all other census tracts in 2010.

Table 14.2 displays the results for the various multilevel models for change along with 95% confidence intervals for each parameter. Model 1 shows the unconditional growth model, which models the initial poverty rate (intercept) and time (rate of change) without any predictor variables. This model shows that census tracts in Bexar County have an average of 15.3% poverty in the decades from 1980 to 2010 with a decennial rate increase of 0.9 percentage points. In other words, not controlling for any predictors, poverty increases with time for Bexar County neighborhoods. Since all predictors in Model 2 have been centered with a mean of 0 and standard deviation of 1, the intercept is the average poverty in Bexar County when all predictors are at average values. This interpretation of the intercept changes in Model 3 with the introduction of the Westside and Eastside dummy variables. In Model 3, the intercept is the poverty rate when all predictors are at average values and when both the Westside and Eastside variables are zero, i.e., the intercept is the poverty rate for all other non-Westside/Eastside census tracts. The same interpretation holds for the intercept in Model 4, but for non-legacy tracts.

Table 14.2 Multilevel model for change in poverty rate for San Antonio, Texas from 1980 to 2010 using time-variant and time-invariant predictors (Tracts =347)

		Model 1	Model 2	Model 3	Model 4
Variables	Parameter	β	β	β	β
Fixed effects					
Intercept	γ_{00}	15.29∗∗∗ (13.85–16.72)	15.29∗∗∗ (14.69–15.88)	14.63∗∗∗ (14.04–15.24)	12.58∗∗∗ (11.85–13.31)
Time	γ_{10}	0.89∗∗∗ (0.53–1.24)	0.89∗∗∗ (0.56–1.22)	0.89∗∗∗ (0.57–1.2)	0.89∗∗∗ (0.58–1.19)
Homeownership Rate	γ_{20}		−1.27∗∗∗ (−1.74–0.81)	−1.37∗∗∗ (−1.83–0.92)	−1.33∗∗∗ (−1.81–0.86)
Foundation Homes	γ_{30}		0.110 (−0.47–0.69)	−0.141 (−0.71–0.43)	0.79∗∗ (0.23–1.35)
Employed	γ_{40}		−1.19∗∗∗ (−1.66–0.72)	−1.02∗∗∗ (−1.48–0.56)	−0.86∗∗∗ (−1.34–0.38)
Single-Mother HH	γ_{50}		3.29∗∗∗ (2.81–3.76)	2.59∗∗∗ (2.10–3.08)	2.85∗∗∗ (2.36–3.34)
Bachelors+	γ_{60}		1.44∗∗∗ (0.76–2.12)	0.96∗∗ (0.27–1.64)	−0.24 (−0.81–0.33)
Hispanic	γ_{70}		3.60∗∗∗ (2.85–4.36)	4.28∗∗∗ (3.49–5.06)	3.77∗∗∗ (3.00–4.53)
Population Change	γ_{80}		−0.93∗∗∗ (−1.33–0.52)	−0.93∗∗∗ (−1.33–0.54)	−0.62∗∗ (−1.00–0.23)
Variables of Interest					
Legacy neighborhood	γ_{90}				9.29∗∗∗ (7.7–10.88)
Dropout rate	γ_{100}		5.27∗∗∗ (4.28–6.27)	3.97∗∗∗ (2.96–4.98)	
West	γ_{110}			3.45∗∗∗ (1.64–5.26)	
East	γ_{120}			11.93∗∗∗ (9.33–14.53)	
Variance components					
Level-1 within-tract	σ^2_ε	24.15∗∗∗	32.24∗∗∗	30.31∗∗∗	29.36∗∗∗
Level-2 intercept	σ^2_0	167.11∗∗∗	9.02∗∗∗	6.63∗∗	8.12∗∗∗
Time	σ^2_1	6.72∗∗∗	3.12∗∗∗	2.93∗∗∗	2.24∗∗
AIC		9769.6	9141.6	9063.6	9100.7

Data from 2010 Neighborhood Change Database; ∗P<.05, ∗∗P<.01, ∗∗∗P<.001

Model 2 adds controls for ecological, neighborhood desirability, and population change along with the dropout rate, which is a variable of interest. This model shows that the homeownership rate, proportion employed, and population change variables have a negative relationship with poverty as standard deviation increases in each lead to drops in neighborhood poverty. These results show that neighborhoods which have experienced increases in population have also had decreases in poverty which may be a consequence of migrations of higher income individuals out of the higher poverty areas. Without knowing the demographic characteristics of the individuals who moved, it is not possible to know for certain if this mechanism is responsible for changes in neighborhood poverty rates. Further research is needed to tease out this effect. In this model, the proportion foundation homes does not have a significant relationship with poverty in Bexar County; in other words, age of housing structures is not correlated with neighborhood poverty. The proportion single-mother headed households, the proportion bachelor's degree or greater, and the proportion Hispanic all have a positive relationship with neighborhood poverty. The confidence intervals for proportion Hispanic indicate that a standard deviation increase leads to between a 2.9 and 4.4 percentage point increase in neighborhood poverty, and a standard deviation increase in the proportion of single-mother headed households leads to between a 2.8 and 3.8 percentage point increase in poverty. The dropout rate potentially predicts the most change in poverty with a one standard deviation change leading to between a 4.3 and 6.3 percentage point increase.

Model 3 adds controls for Westside and Eastside neighborhoods to Model 2. All variables retain their relationship with poverty with some changes in the strength of the relationships. With the addition of these dummy variables, the strength of proportion Hispanic and proportion dropout rate change. A one standard deviation change in proportion Hispanic now leads to between a 3.5 and 5.1 percentage point increase in poverty, while a standard deviation increase in proportion dropout leading to between a 3.0 and 5.0 percentage point increase in poverty. The results also show that the Eastside has the strongest correlation with poverty, with Eastside tracts having between 9.3 and 14.5 percentage points higher poverty. The Westside also has higher poverty compared to all other census tracts in Bexar County aside from the Eastside. Clearly, past research investigating disparities in the Westside area is supported, and these results warrant new research focusing on the Eastside of San Antonio as well.

Finally, Model 4 in Table 14.2 takes out the dropout rate and the dummy Westside/Eastside variables in order to see the effect that dropout legacy neighborhoods have on Bexar County poverty. This variable attenuates the relationship that the proportion of college educated individuals has with poverty. The proportion college educated variable is no longer significant in Model 4, which includes the dummy dropout legacy variable. Furthermore, the strength of the relationship between proportion Hispanic and poverty is also diminished. The results show that neighborhoods designated as having a dropout legacy have between 7.7 and 10.9 percentage points more poverty than non-legacy neighborhoods. Considering that the average Bexar County poverty rate has been between 14% and 19% throughout the five decades under study, this is an important and substantial finding. Clearly there is a substantive difference between neighborhoods with persistently high dropout rates and those without this attribute. I argue that this difference is due to the structure of residential segregation and school district formation in Bexar County. I address this and other issues in the next section of the chapter.

14.6 Discussion

I conducted socio-historical and empirical analyses of poverty in Bexar County, Texas in this chapter to demonstrate the importance of considering historic neighborhood formation processes in investigations of contemporary outcomes, specifically neighborhood poverty. I introduced dropout legacy as a neighborhood attribute which is formed through past residential and school segregation which subsequently affects contemporary neighborhood educational outcomes and contemporary neighborhood compositions. In Bexar County, I argued that processes of historic neighborhood racial and economic segregation together with school district formation allocated social and financial resources disproportionately to neighborhoods in the county. These processes are reinforced through school financial schemes that allocate resources to districts based on property tax revenue in these segregated neighborhoods. I focused on the Westside/Eastside areas and dropout legacy neighborhoods in terms of historic poverty trends to show the deleterious outcomes of these historic structural processes. The results show reasons for much scholarly and media focus covering poverty in the Westside of San Antonio (Bauder 2001; Bauder and Sharpe 2000; Carr et al. 1968; Clayson 2002; de Oliver 2001; Telles and Ortiz 2008), as the Westside has had between 1.6 and 5.3 percentage points higher poverty than other non-Westside neighborhoods from 1980-2010. Recently, the national spotlight has focused on the Eastside of San Antonio, as it now houses two federal neighborhood revitalization grants (City of San Antonio 2015). The results support a need for Eastside poverty to be highlighted, as census tracts in this area experienced the highest poverty (9.33–14.53 percentage points higher) compared to all other census tracts.

In Bexar County, the neighborhood dropout rate is consistently one of the strongest predictors of neighborhood poverty in the next decennial census. The results presented earlier in Model 4 of Table 14.2 clearly show that census tracts designated as having a dropout legacy have the strongest relationship with Bexar County poverty over time, with dropout tracts experiencing between 7.7 and 10.9 percentage points more poverty. This relationship is especially concerning considering that it disproportionately affects certain school districts. As can be seen in Fig. 14.1 (above), San Antonio ISD, Edgewood ISD, South San Antonio ISD, Harlandale ISD, Southwest ISD, Somerset ISD, Southside ISD, and the Bexar County portion of Medina ISD have a majority of their neighborhoods identified with a dropout legacy. On the other hand, East Central ISD, Alamo Heights ISD, Judson ISD, Northside ISD, North East ISD, Schertz-Cibolo-Universal City ISD, and the Bexar County portions of Boerne ISD and Comal ISD have none or very little of their neighborhoods with a dropout legacy. As I have argued, the disproportionate nature of the spatial configuration of dropout legacy neighborhoods is directly correlated with the historic construction and current perpetuation of school district fragmentation.

The spatial configurations of dropout legacy neighborhoods is further troubling as additional analyses of the spatial and temporal dimensions of neighborhood

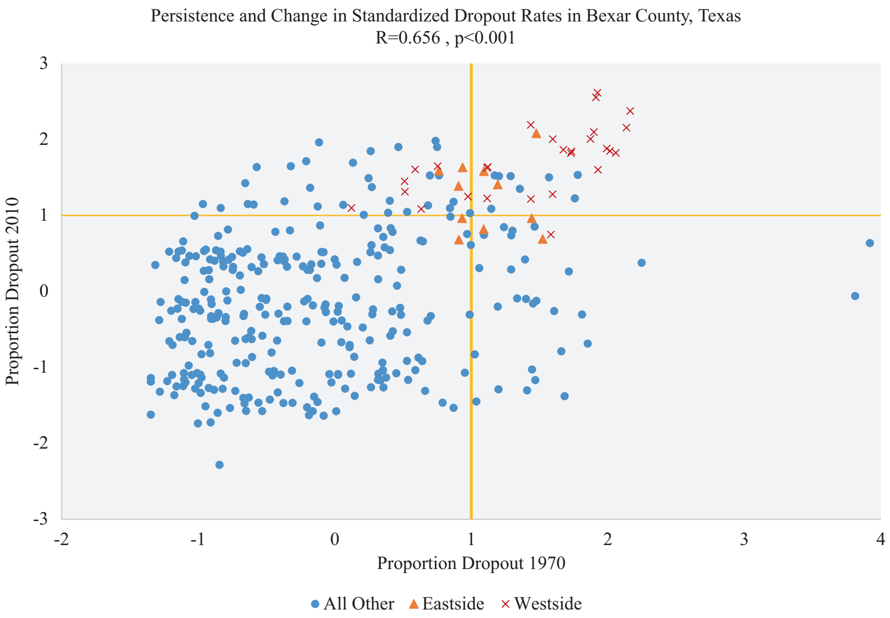

Fig. 14.5 Persistence in change in dropout rates in Bexar county, Texas

dropout rates reveal that they are more intractable when compared to poverty. Figure 14.5 displays the results of a scatterplot of 1970 standardized dropout rates and 2010 standardized dropout rates. These show a higher correlation between dropout rates in 1970 and 2010 than 1970 and 2010 poverty rates (0.656 vs. 0.504). A majority of Westside tracts reside in the stable high dropout rate quadrant (upper-right) with the rest characterized with worsening relative dropout rates (upper-left). Meanwhile over half of Eastside tracts have above average dropout rates in 2010. Only one Westside tract and five Eastside tracts had average or below dropout rates in 2010. When compared to the scatterplot for poverty in Bexar County displayed in Fig. 14.3, Fig. 14.5 shows less mobility of Westside and Eastside neighborhoods in terms of dropout rates with more neighborhoods being marked by stable high dropout rates.

14.7 Policy Implications & Conclusions

The stubborn nature of concentrated high neighborhood dropout rates should be one of great concern for policy creation in Bexar County due to the strong relationship that dropout rates have with neighborhood poverty. These dropout legacy areas need to be understood for how they are formed and sustained. I have argued in this chapter that the formation of these areas stem from historic neighborhood and school district formation. These neighborhoods are reified through the unchanging nature of school district boundaries, the funding sources tied to neighborhood property taxes, and a lack of policy to eliminate the consequences of structural racism. In light of the findings presented here, research should be directed towards the social costs of maintaining the funding and school district structure for Bexar County and the state of Texas. Thus far, only economic considerations have been investigated (Taylor et al. 2014), thus posing a very limited scope of the rationale for considering school district consolidation.

Aside from school district consolidation, other approaches could be taken to address the problem of seemingly intractable high neighborhood dropout rates, which in turn could likely assuage neighborhood poverty in Bexar County. One solution involves challenging the precedent that education is not a fundamental right guaranteed by the Constitution set by the courts in *San Antonio ISD v. Rodriguez* (1973).

Proponents of educational equality in terms of funding and attainment outcomes could continue to introduce legal action which serves to override this decision (e.g. *Edgewood ISD V. Kirby* et al. (1991)). Hypothetically, if education is a right protected by the Constitution, the potential arises for individuals or school systems to file suit if this right becomes impeded. In this sense, equity would become a legal issue brought to the legal system for legal remedies. On the other hand, educational equality can be had through local municipal and state government policies. These policies may be more adept to local structures and be better suited to tackle the specific mechanisms producing inequality on a local level.

The solution advocated for here is a holistic process which includes both a push for jurisprudence protections of a basic Constitutional right to adequate and equal education and advocacy for policies designed to bridge educational gaps between resource poor and resource rich districts. If judicial protections are not in place and if local funding structures make it improbable for certain schools to acquire necessary financial resources to adequately educate students, then resource poor schools are left to the charity of resource wealthy school districts through resource sharing (Spradlin et al. 2010). On the other hand, if courts dictate that education is in fact a fundamental right that should be protected by the Constitution, yet there is no legislative buy-in, then this ruling loses its significance. The only solution that will work is to have both pillars of support – legislative and judicial. This way, resource poor districts can make a legal plea for equality of resource allocation and can have legislative push to create policies that help protect this fundamental right.

Within the framework of this holistic solution should be a consideration of creating one county school district in Bexar County. This solution would have the potential to (1) save taxpayers money through the alleviation of poverty and the social dislocations like crime and teenage pregnancy that flow from concentrated poverty (Jencks and Mayer 1990; South and Crowder 2010); (2) open up the teaching job market to highly qualified teachers; (3) open up the housing market to all residents (Semuels 2015); and (4) lead to long lasting neighborhood change. Alongside national policies and court protections, local state and county governments will need to be on the forefront of undoing negative legacies of place that former practices established and current disparities reinforce. I believe the solution proposed here does this. The solution outlined requires all residents to have a stake in the welfare of all children in the county.

No longer can neighborhoods separate themselves from the responsibility of the greater metropolitan area while still benefiting from the resources and access that it provides. No longer should residents in affluent areas be allowed to ignore the damning of children in property-poor districts and schools while still enjoying the amenities of the larger area. All residents in Bexar County should have a compelling interest in the general welfare of the area for when the county prospers, all residents prosper as well (Briffault 1996; Holme 2013). For example, where would Alamo Heights be if not for the broader economic success and attention brought forth by the city of San Antonio? Furthermore, if the county experiences higher educational attainment for all, a decline in poverty and crime may be a natural consequence of this increased attainment. By not contributing to the general welfare of the area, segregated affluent neighborhoods make it more difficult to ensure their own future success for their neighborhood's well-being is intricately tied to Bexar County. A more just policy that strives for the best outcome for all students will ultimately positively affect all residents of the county, not just poor ones. Without a holistic approach to deal with the effects of dropout legacy in Bexar County, it is difficult to see how neighborhoods with intractable poverty and dropout rates can experience positive transition.

A microcosm of the lack of a holistic solution can be seen in the current push for Alamo Ranch, a wealthier suburb of Bexar County on the far west side, to incorporate so that it can keep money and control local decisions regarding education (Davila 2015). Given the history of neighborhood segregation and school district formation, one wonders if this new city would want its own school district so that economic and social resources remain within its tight boundaries? How would a new school district affect the surrounding neighborhoods; would the current district see a loss of revenues further draining valuable resources from current schools? If the incorporation occurs, it is not a farfetched idea that the process of structural racism would be seen in this new municipality and its surrounding neighborhoods. Dropout legacy is not just a thing of the past, but its effects are felt presently in Bexar County. There is a very real potential for new dropout legacy neighborhoods to form if the current school structure policy, especially with respect to funding and district stability, is not changed towards equality and fairness for the benefit of all students and neighborhoods.

The importance of the research I presented in this chapter reaches beyond Texas and even beyond the study of education as the findings reverberate outward to other studies of concentrated poverty. Researchers' understanding of poverty in major American cities has often followed findings from cities like Chicago and Los Angeles (Sampson 2012; Sanbonmatsu et al. 2011; Telles and Ortiz 2008; Wilson 2012). By focusing on Bexar County, which is currently and historically composed of a majority Hispanic population, the research I presented herethis adds both to the literature on the relationship of race and urban poverty and highlights how the history of place helps in understanding contemporary outcomes and possible solutions.

I have added to the discussion on concentrated poverty a consideration of dropout legacy as a mechanism that accounts for historic and contemporary structural racism. Future studies on neighborhood change, particularly as it relates to poverty, should account for the history of place-based socio-political decisions and, as is shown here, dropout legacy is one way to quantify this concern. Due to the socio-political mechanisms leading to areas with a dropout legacy in Bexar County, school district consolidation should be considered as a device for alleviating concentrated poverty in the area which, by extension, can go a long way in securing the educational fortunes of neighborhoods and individual students living in these neighborhoods.

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Chapter 15
Union Formation Selectivity After Childbearing: Do Local Marriage Markets Matter?

Gabriela Sánchez-Soto

15.1 Introduction

Since the 1970s, people in the U.S. have been more likely than in the past to experience union separation and re-partnering, and children have been more likely to experience more than one kind of family arrangement throughout their childhood (Bzostek et al. 2012; Cherlin 2009, 2010). Previous research has paid important attention to the outcomes of children growing up in step-families and the determinants of union formation of parents. Significant research has focused on the experiences of single mothers. However, less attention has been given to the role of marriage markets on the formation of unions among single parents, and the differences in the impact of marriage markets for men and women with children. The main goal of the research I present in this chapter is to provide a better understanding of the context of union formation after childbearing, with special focus on its determinants and the influence of local marriage markets. I particularly focus on how these effects differ for men and women.

For women, marriage is no longer an economic strategy used to attain financial security; instead, it is seen as a milestone or a status symbol that people with higher socioeconomic status are more likely to have (Cherlin 2004). Men and women with low socioeconomic status may have limited access to suitable partners, especially if they are parents. On the one hand, partners of higher socioeconomic status are more likely to be perceived as more marriageable; on the other, partners with more attractive characteristics may be less likely to want to form a union with single parents due to the increased obligations and pressures that come from step-family arrangements. For people perceived as less eligible or marriageable, cohabiting unions may provide an alternative to marriage. In contrast, people with higher socioeconomic

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status are more likely to get married and enter more stable unions (Lichter et al. 2006; Edin and Kefalas 2005). In the case of women, higher socioeconomic status may also be related to the opportunity to wait longer for a suitable partner when they are scarce (Lewis and Oppenheimer 2000; Oropesa et al. 1994).

Analyzing the differences in the processes by which single parents enter unions and match with different types of partners is important for understanding the outcomes of step-families. Previous research describes two possible explanations for the role of marriage markets on the union formation of single parents: these are marriage selectivity and marital search theory. Marriage selectivity suggests single parents with coresidential children are more likely to form unions with the least desirable partners in a geographic location. Marital search theory expects parents to approach the marriage market with an emphasis on finding the most suitable partner to be a co-parent. These effects are particularly pronounced for single mothers. To test the effects of these perspectives on the probability of union and step-family formation, I use data from the first two waves of the National Survey of Families and Households (NSFH) and estimate the impact of local marriage market conditions on the relative risks of cohabitation or marriage with and without children for men and women.

Stepfamilies are pervasive in the United States. In the early 1990s it was estimated that one-third of Americans will reside in stepfamilies for at least a portion of their childhood, and one-fourth of these families will cohabit (Bumpass et al. 1995). A large body of research suggest that stepchildren are more vulnerable to a host of negative consequences, e.g., teenage pregnancy, high school dropout, and behavior/emotional difficulties, compared to children in two-parent families and even to those in single-mother families (Cooksey and Fondell 1996; Sweeney 2010). Upon union dissolution, mothers in the United States are significantly more likely than fathers to retain physical custody of biological children (Argys et al. 2007). Therefore, children are more likely to live full-time with stepfathers as opposed to stepmothers, suggesting that children in stepfather-biological mother families are at an increased risk for negative outcomes. Although the outcomes associated with stepfamilies have been well documented, more research on the potential selectivity mechanisms behind the formation of stepfamilies is still needed, especially in trying to discern the determinants of negative outcome outcomes that may be attributable to difficulties making stepfamily transitions. We also need to know more about whether stepparents are more likely to form unions with lower quality partners.

The latter explanation is the crux of the marital selectivity perspective, which suggests that lower-status men are negatively selected into stepfamilies by virtue of being undesirable to childless women. This is particularly important in a context where single mothers are more likely to be the coresidential parent. Though women may not necessarily have much information about a man's parenting skills prior to cohabitation or marriage, it is expected that men with limited financial resources and lower levels of education would be deemed as less desirable in the marriage market. On the flipside, we should also consider how the process of stepfamily formation differs for women at the risk of becoming stepmothers and whether women who are seen as less desirable partners in the marriage market are more likely to enter step-parenting situations. Without accounting for the availability of potential mates in the marriage market, the expectation that less suitable partners are more likely to marry single parents cannot be appropriately tested. However, according to expectations from marital search perspectives, a competing argument would be that even the most disadvantaged mothers resist marriage to less suitable partners, choosing instead cohabitation, or continued single motherhood (Edin and Kefalas, 2005; Lichter et al. 2006). Accordingly, the research I report in this chapter explores the role of the marriage market on the formation of stepfamilies by using information on the sex ratio composition of the place of residence, and it examines the competing explanation from marital search models by exploring the role of the socioeconomic characteristics of the people entering into stepfamilies. In addition, I compare the determinants of entering into cohabitations versus marriages with men and women with and without children.

Using data from Waves 1 and 2 of the National Survey of Families and Households, I estimate the probability of entry into three family types relative to entering a marital union with no stepchildren: (1) cohabiting with no stepchildren; (2) cohabiting with stepchildren; (3) married with stepchildren. This chapter contributes to the literature on stepfamily formation by exploring its determinants and the role of two contrasting mechanisms: marital selectivity and marital search models. The chapter is organized as follows: I first present a summary of the mechanisms that I suggest would help explain stepfamily formation; I follow with a description of the data and methodology; third I present descriptive and multivariate analyses results; and I close with conclusions and the implications of my research for an understanding of stepfamily formation.

15.2 Marriage Selectivity

Union formation is not subject to personal preferences alone. Rather, it is also impacted by third party influences, e.g., cultural norms and group expectations, as well as by the supply and demand of suitable partners in the local marriage market (Kalmijn 1998). Research on this topic has typically utilized sex ratios, i.e., the ratio of available males to available female partners, to test the effect of marriage market conditions on union formation (Çelikaksoy et al. 2010). Although a shortage in terms of quantity and quality of potential male partners has been shown to delay first marriage among women (Lichter et al. 1992), it remains to be seen whether marriage market conditions similarly affect stepfamily formation.

Marriage Market Conditions High sex ratios, e.g., an abundance of men in relation to women, in (re)marriage markets fosters conditions that are favorable to women. Under these conditions, women enjoy a higher number of potential mates and, therefore, a higher number of suitable potential mates with whom they may partner. Further, women also face less competition from other women during the mate selection process. Alternatively, when the sex ratio is low and men with desirable qualities are in short supply, women with less desirable characteristics must compete against more attractive, e.g., childless and/or younger, women for potential mates. Under these conditions, the most attractive women have greater access to the most suitable male partners, e.g., the employed and the more educated, leaving women with the least attractive qualities to partner with less desirable mates.

Union Type There is evidence that marriage market conditions impact marital and cohabiting outcomes differently (Guzzo 2006). Research suggests that women are universally more inclined to marry, while men prefer to cohabit or remain single. In particular, Edin and Kefalas' (2005) work with unwed mothers suggests that women with little access to quality men were less likely to be married. However, it was not that these women are shunning the institution of marriage, rather they remain unmarried because they recognize that the men available to them are not good marriage prospects in that many of these men often experience periods of unemployment and underemployment. Further, marriage market conditions that favor women, i.e., fewer women, more men, are associated with an increased likelihood of marriage. In contexts where women are in short supply, they are imbued with increased "dyadic power" (Guzzo 2006), which they may use to negotiate marriage. When women are in short supply, men would be more motivated to marry, while in a marriage market where there are more marriageable women, men would be more likely to delay or avoid marriage (Lichter et al. 1995; Lloyd and South 1996).

There is some evidence that fathers who have children from previous marriages may have increased incentives to recreate a familiar family structure, making these men more likely to re-partner (Goldscheider and Sassler 2006). Further, involved nonresident biological fathers are significantly more likely to enter unions, compared to other men (Stewart 2003). As time goes on, men have an opportunity to increase their desirability through age, life experience, and demonstrated economic stability. Moreover, custodial fatherhood may signify a man's potential to successfully parent in the remarriage market. Therefore, it is possible that the value women, both childless and otherwise, place on responsible parenting offsets the financial burden of single fathers' coresidential children.

Stepfamily Formation The stepfamily literature largely considers parents with coresidential children from previous unions to be disadvantaged in the (re)marriage market, especially mothers. Both childless men and single fathers prefer to partner with younger women (Buckle et al. 1996) and with women who have few or no children (Goldscheider et al. 2009). Coresident children represent a resource drain, which is especially pronounced for women. Women are more likely to be financially disadvantaged—which is likely worsened by union dissolution—and more likely have coresidential children who further deplete financial resources.

Moreover, women who return to the remarriage market upon terminating a coresidential relationship that produced children are likely to be older than their childless counterparts, compounding single mothers' disadvantaged status (Lichter and Graefe 2007). Since children further reduce financial resources, single mothers may be burdened by a combination of the least desirable characteristics in the remarriage market. In sum, the "marriage selectivity" perspective predicts that more suitable male partners have a higher likelihood of forming non-stepfamily unions. Alternatively, men with undesirable qualities may be "negatively selected" into step-parenthood by virtue of the marriage market (Hofferth 2006; Hofferth and Anderson 2003).

15.3 Marital Search

Conversely, Oppenheimer's marital search theory argues that women with sufficient financial resources will continue to search for preferable mates, as opposed to settling for unsuitable men (Oppenheimer 1988). Indeed, recent research finds that single mothers approach the marriage market with higher standards for new partners and an emphasis on seeking "good providers." Further, mothers who possess such desirable traits as being employed and having few or no children, are likely to "trade up" in terms of new partners' economic potential, and mothers with greater access to financial resources are more likely to prolong the marital search as opposed to "settling" for a partner with poor earning potential (Bzostek et al. 2012). Interestingly, extended marital searches have also been observed among the most disadvantaged women in the marriage market, namely, unwed mothers. Despite limited financial resources, it seems that unwed mothers also resist marriage to less suitable partners, choosing instead to cohabit, or to continue on as single mothers (Edin and Kefalas 2005; Lichter et al. 2006). This is a situation that stands in direct contradiction to the expectations of marriage selectivity perspectives.

15.4 Research Aims and Expectations

While there is evidence that men with lower levels of education and limited income—traits that are often associated with negative selection—are overrepresented in stepfamilies (Goldscheider and Sassler 2006), previous research has not expressly tested the impact of marriage market conditions on stepfamily formation (Goldscheider and Kaufman 2006; Hofferth 2006; Hofferth and Anderson 2003). The analysis I undertake in this chapter will link data on men and women who formed unions between the first two waves of the National Survey of Families and Households (NSFH) (Sweet and Bumpass 1996; Sweet et al. 1988) with contextual data derived from the 1990 Census and 1990 PUMS-L to answer the following questions: (1) Do marriage market conditions significantly impact union formation for men and women? (2) Do marriage markets have a different effect for men and women entering unions where step-children are present? And (3) Do partner characteristics have an effect on the type of union that individuals enter?

My research explores two opposing expectations. The marital selectivity perspective expects that marriage market conditions will significantly affect the quality of partners available to form co-residential unions. When marriage markets favor women, I expect more desirable partners, e.g., the employed, will enter unions with single mothers. When marriage markets favor men, I expect that they would be less likely to enter unions with step children. Since marriage market favorability imbues the scarcer sex with negotiating power, I would expect that sex ratios that favor women would mean higher likelihood of marriage for stepfamilies. Alternatively, when marriage markets favor men, I expect the least desirable male partners to enter stepfamilies and that a majority of these families will cohabit.

Conversely, the marital search perspective states that despite their expected disadvantage in the marriage market, single parents, particularly mothers, will be more selective of higher order partners due to social learning, and to a more pronounced need for economic stability. Thus, I would expect a positive and significant association between partner's demographic and economic characteristics and the likelihood of entering unions with parents. In comparing these two perspectives, I focus in this chapter on the relative validity of these two perspectives to explain the risks of forming stepfamilies and on differences between men and women.

15.5 Data and Methods

15.5.1 Sample Selection and Characteristics

The individual-level data come from the first and second waves of the National Survey of Families and Households collected by the University of Wisconsin-Madison's Center for Demography and Ecology (Sweet and Bumpass 1996; Sweet et al. 1988). The first wave of the NSFH (1987–1988) was a national probability sample, which collected individual-level survey data from 13,008 primary respondents aged 19 years and older. The second wave of NSFH (1992–1994) re-interviewed 77% of the original primary respondents, resulting in a total of 10,005 cases. The NSFH includes detailed information on union histories, partner characteristics and attitudes towards union formation and parenting. Additionally, the sample design oversamples families with stepchildren, single parent families, cohabiting couples and recently married individuals.

This analysis selects respondents who were between 19 and 54 years old at Wave 1. It then, identifies 3756 respondents (1) who were not cohabiting or married at NSFH1; or (2) who dissolved cohabiting or marital unions between NSFH1 and NSFH2; and (3) who were re-interviewed at NSFH2. These 1369 men and 2387 women were analyzed in the first stage of this research to estimate the probability of entering a marital or cohabiting union relative to staying single. Among this sample, a majority remained single at Wave 2 (57% of men and 67% of women), while 12% of the men and 9.5% of the women entered cohabiting unions, and 31% of the men and 24% of the women entered marital unions between NSFH waves.

The second analytical sample is used to estimate the probability that individuals will enter different types of family arrangements among those who entered unions, which leaves 571 men and 721 women in the sample. Among the men who did enter unions, the most prevalent is marriage without stepchildren (59%), followed by those who cohabit without children (20%). The least prevalent unions were among those who entered unions where stepchildren are present, either marital (13%) or cohabiting (8.5%). For their part women were most likely to enter marriages without stepchildren (66%) or cohabit without stepchildren (27%), unions with stepchildren were the least prevalent among women (1.8% cohabitation, 5% marriages).

To estimate whether partner characteristics have an effect on the type of family that an individual enters, I select a third analytical sample of those who have available information on the characteristics of their partners/spouses to test the marital search hypothesis. I have data on 468 men and 491 women for this part of the analysis. Table 15.1 presents the characteristics of each of these samples.

On average, those men and women at risk of entering a union were, on average, 29 and 32 years old at Wave 1, respectively. About two thirds were non-Hispanic white. Over one third had a high school diploma, and 66% of the men and 45% of the women were employed full-time. Men in the sample report an average of $16 thousand dollars per year, whereas for women the average was close to $10 thousand dollars per year. Almost three-quarters of the men come from two parent households, compared to 66% of the women. Just over 60% of the men and 43% of the women have never been married at Wave 1. Further, 17% of the men and 49% of the women had biological children living with them at Wave 1.

In order to determine the composition of the labor market in which each of the individuals in the sample lived, my research study links the above NSFH individual records to the 5% sample of the 1990 Census and 1990 PUMS-L data aggregated at the Labor Market Area (LMA) level. This level of geography has often been used to approximate marriage markets (Guzzo 2006; Harknett 2008; Lichter et al. 1992). The aggregate-level data include information for 394 LMAs, which were based on journey-to-work patterns identified in the 1990 Census Commute-to-Work data file (Guzzo 2006). These aggregate-level data were matched to the individual-level data by the NSFH after I obtained restricted-data access. Given the increased likelihood of encountering remarriage partners within work and living boundaries—especially among the previously partnered—I expect partnering and re-partnering markets to correspond especially well to LMAs. Finally, using the period between the first and second waves of the NSFH (4–7 years) allows the present analysis to avoid issues tied to the diminishing accuracy of marriage market measurement over a long period of time (Lichter et al. 1992; Lloyd and South 1996). Previous research measuring the impact of marriage market conditions addressed this concern by restricting analyses to 5 years before and after each Census (Parrado and Zenteno 2002).

Table 15.1 Weighted sample characteristics, respondents at risk of entering a union, by sex

	At risk of entering union		Entered union by stepfamily status		Partner/Spouse characteristics available	
Variables	Men	Women	Men	Women	Men	Women
Family formation by union type						
Did not enter union	57.2	66.6				
Cohabiting union	12.1	9.5				
Marital union	30.7	23.9				
Cohabiting with stepchildren			8.5	1.8	6.6	1.7
Cohabiting without stepchildren			19.8	26.8	17.4	23.4
Married with stepchildren			13.1	5.0	14.0	5.4
Married without stepchildren			58.6	66.5	61.9	69.4
Individual characteristics						
Age[a]	28.9	31.9	27.4	27.1	27.1	26.6
Race/ethnicity[a]						
White non-Hispanic	79.8	72.7	85.0	82.6	85.1	84.9
Black non-Hispanic	13.5	19.5	8.5	10.4	8.7	10.8
Hispanic	6.7	7.7	6.5	6.9	6.1	4.3
Education[a]						
Less than high school	12.7	16.1	10.9	12.8	11.4	11.8
High school	36.9	38.1	39.2	38.7	41.0	38.5
Some college	32.3	30.6	30.6	33.7	29.4	34.7
College graduate	18.1	15.2	19.4	14.8	11.2	15.0
Employed full-time[a]	65.5	45.3	70.5	47.2	70.2	46.1
Mean earnings[a, b]	16207.2	9893.7	16242.7	9653.4	15917.6	8855.0
Mean logged earnings[a, b]	8.2	6.8	8.3	7.2	8.4	7.0
Social learning characteristics						
Two-parent biological family[a]	72.8	65.8	75.4	67.7	76.3	66.5
Never married[a]	60.6	42.5	60.1	50.9	59.7	51.9
Coresidential biological children[a]	16.6	49.2	15.4	41.6	16.3	40.1

(continued)

Table 15.1 (continued)

	At risk of entering union		Entered union by stepfamily status		Partner/Spouse characteristics available	
Variables	Men	Women	Men	Women	Men	Women
Contextual characteristics						
Mean labor market area sex ratio[c]	1.4	1.4	1.5	1.4	1.4	1.4
Partner/wife characteristics						
Age					30.6	34.7
Race/ethnicity						
White non-Hispanic					86.8	84.0
Black non-Hispanic					7.4	11.5
Hispanic					5.8	4.5
Education						
Less than high school					24.2	17.2
High school					29.9	37.9
Some college					31.3	27.1
College graduate					14.6	17.8
Employed full-time					51.4	81.2
N (unweighted)	1369	2387	572	721	468	491

Source: NSFH1 (1987–1988), NSFH2 (1992–1994), 1990 Census. Weighted frequencies
[a]Measured at NSFH1
[b]Earnings information based on valid cases before multiple imputation
[c]Measured in 1990

15.5.2 Dependent Variable

The primary objective of my research is to determine whether marriage market and partner characteristics are related to the probability of entering unions with people who already have coresidential children. Due to limitations tied to aggregate-level data linked to NSFH primary respondents at re-interview, the analysis is limited to individuals who formed unions at follow-up. Therefore, those who entered into a cohabiting union that dissolved prior to re-interview are not included in the sample. I use two main dependent variables. First, to estimate the probability and determinants of entering any union, I use a categorical variable that indicates whether the respondent was (1) Single, (2) cohabiting, or (3) married at the follow-up. The second and third parts of the analysis only select those who entered unions during the study period, and the dependent variable measures four types of family formation that indicate whether the respondent is (1) married without stepchildren; (2) married with stepchildren; (3) cohabiting without stepchildren; (4) cohabiting with stepchildren.

15.5.3 Marriage Market Conditions

Building on existing research, I use sex ratios to capture marriage-market conditions measured at the Labor Market Area level. This measure is defined as the proportion of men, often limited by age, marital status and other characteristics, to the proportion of women. In her study of the impact of marriage market conditions on cohabiting and marital union formation, Guzzo (2006) compared a broad sex ratio, measured as the proportion of unmarried men 16–49 to unmarried women 18–44, to more restrictive age ranges. Results suggest that Guzzo's measure had a better model fit than narrower age- and employment-adjusted sex ratios. Further, coefficient significance and magnitude were "similar but attenuated" for the broad measure as opposed to those using the more restrictive sex ratios (Guzzo 2006).

The measure I use in this research divides the number of unmarried men 16–49 of each respective race/ethnicity by the number of unmarried women 18–44 of each respective race/ethnicity in each LMA. Labor Market Area sex ratios for this sample have a mean of 1.37 with a standard deviation of 0.342. A sex ratio of 1 indicates the number of men is equal to the number of women, while a sex ratio above 1 suggests favorable marriage market conditions for women. In preliminary analyses, I used sex-ratios that were not specific by race/ethnicity. However, by using a more specific measure, I can account for the significant differences in the proportion of minority men to women in certain LMAs. To illustrate these disparities, the weighted mean sex ratio for non-Hispanic white respondents in this sample is 1.4, compared to 1.1 for non-Hispanic black respondents, and 2.2 for Hispanic respondents. Given the higher unemployment, mortality, and incarceration rates for black males in the U.S., in many marriage markets there is a lower availability of eligible black males, even with the wider age bracket used in this measure (Lloyd and South 1996). On the other side, most of the growth in the Hispanic population of the U.S. comes from in-migration, and throughout the history of Latin American immigration to the U.S., the flow has been mostly dominated by males traveling in search of better work opportunities. Eventually, through family reunification and higher rates of female labor migration, the number of Hispanic women in the U.S. has increased. However in many geographies and labor markets, the Hispanic population of marriageable age is heavily male, resulting in skewed marriage markets (Donato 1999, 2010). In fact, within the distribution of this sample, Hispanics had the widest distribution of sex ratios.

15.5.4 Social Learning Characteristics

Respondent's family background is an important indicator of his socialization into marriage and fatherhood; I use three measures of social learning. The first, as suggested by Sweet et al. (1988), identifies respondents who were raised in two-parent biological families if they reported (1) living with both biological parents at age 16; or (2) responded affirmatively to the following item: *Next, I want to ask you some questions about who you lived with while you were growing up. Did you live with both your biological mother and biological father from the time you were born until age 19, or until you left home to be on your own?* Secondly, individuals who have been previously married would approach stepfamily formation in a different way than those who are marrying for the first time; for those who are re-partnering, entering a union with a woman who has children from a previous relationship may be less of an issue than for men who are getting married for the first time and thus are not socialized into marital life. I use a dichotomous variable that measures whether the respondent was never married before the union of reference. Lastly, previous research on the topic of stepfamily formation found that custodial fathers are more likely to form stepfamilies than childless single men (Goldscheider and Sassler 2006). Therefore, my analysis includes a dummy variable indicating whether respondents reported at least one coresidential child at Wave 1.

15.5.5 Control Variables

Control variables were measured at Wave 1. Respondent age is measured in years. Race/ethnicity is measured as a categorical variable, including white non-Hispanics (reference category), black non-Hispanics, and Hispanics.[1] Education is measured as a categorical variable in four levels of completion: (1) less than high school (reference category), (2) high school diploma (or equivalent); (3) some college and (4) college degree and higher. Employment status is measured by a dichotomous variable that indicates whether the interviewee is currently working 40 h or more a week. Earnings included respondents' wage, salary, and self-employment income, which ranged from $0 to $500,000 or more. I use the natural logarithm of respondent's' earnings in the multivariate analysis. About 8% of the sample had missing information on the income variable (N = 290). In order to maximize the number of cases available for the analysis I used multiple imputation using the MI command in Stata to impute the missing information. All multivariate analyses and descriptive statistics presented in this chapter were estimated using the data created via chained equations and 10 iterations of the multiple imputation procedure.

[1] The NSFH includes a category for "other race," but only 52 cases in the sample were in this category. Given the small sample size, and the difficulty to reach statistically significant and substantively meaningful conclusions from an "other" category, I decided to exclude these records from the analysis.

15.5.6 Partner/Wife Characteristics

Marital search perspectives expect that women's financial resources will allow them to continue to search for preferable mates, instead of settling for potentially unsuitable men. Women with higher socioeconomic status (SES) have the economic independence to delay forming a union until they find a partner with the desired characteristics. This is likely true for both the single mothers and for women without children. To account for the socioeconomic status of the spouse or partner I include variables such as age, race/ethnicity, education, and full-time employment which are measured in the same way as the equivalent variables I created for each respondent.

15.6 Analysis

The analysis is conducted in three parts. First I estimated multinomial logistic regression models to estimate the probability of entering a union, either cohabiting or marital, relative to staying single (reference category) for all respondents at risk of entering a union. These models are estimated by sex and account for marriage market characteristics, social learning conditions, and other individual level control variables. Next, I estimated multinomial logistic regressions to predict the relative likelihood of forming cohabiting and marital unions, with and without stepchildren at Wave 2, by sex. As mentioned above, this outcome variable includes the following four categories: (1) married with no stepchildren (reference category); (2) cohabiting with no stepchildren; (3) married with stepchildren; and (4) cohabiting with stepchildren. I estimated preliminary models without the marriage market indicators to see if the effect of the other covariates changed after the introduction of the sex ratio indicator; however, as the results are very similar with and without the marriage market indicator, I only present the results here of the full models. Third, I estimated models adding information on the characteristics of the partner or spouse to test whether the effect of marriage market conditions changed when accounting for marital search. These multinomial models use the same dependent variable and independent variables as the previous models.

15.7 Results

In Table 15.2, I present the percent distribution of respondents in the four categories of union type and stepfamily formation by race/ethnicity, education and mean LMA sex ratio for men and women. In the results for men, among non-Hispanic whites and blacks, the most prevalent outcome is marriage with no stepchildren (63% and 40% respectively), with relatively lower incidence of the other categories. Less than

Table 15.2 Union type and stepfamily status, by sex, race/ethnicity, education and MLA sex ratio

	Cohabit		Marry		
	With stepchildren	Without stepchildren	With stepchildren	Without stepchildren	
	%	%	%	%	% Total
	Men				
Race/ethnicity					
White, non-Hispanic	6.2	18.8	12.5	62.6	100
Black, non-Hispanic	23.8	21.6	14.4	40.4	100
Hispanic	19.4	30.4	19.4	30.8	100
Education					
Less than high school	10.8	25.5	9.2	54.6	100
High school	8.9	21.6	16.9	52.5	100
Some college	10.1	14.5	10.9	64.5	100
College graduate	4.0	21.2	11.0	63.9	100
Contextual characteristics					
Mean labor market area sex ratio	1.7	1.4	1.5	1.4	
	Women				
Race/ethnicity					
White, non-Hispanic	1.4	26.0	5.2	67.4	100
Black, non-Hispanic	1.5	35.0	5.2	58.4	100
Hispanic	7.1	23.8	1.7	67.4	100
Education					
Less than high school	2.4	41.4	2.2	54.1	100
High school	2.6	25.6	6.6	65.2	100
Some college	1.5	26.0	4.6	67.9	100
College graduate	0.0	19.0	3.9	77.1	100
Contextual characteristics					
Mean labor market area sex ratio	1.4	1.4	1.4	1.4	

Source: NSFH1 (1987–1988), NSFH2 (1992–1994), 1990 Census. Weighted frequencies

half of non-Hispanic blacks entered cohabitations, with and with no stepchildren. In contrast, Hispanics show a more even distribution of outcomes; 30% are cohabiting without stepchildren and another 30% are married without stepchildren; the remainder of the sample is evenly distributed between those cohabiting or those married with stepchildren. The lowest proportion of marriages with no stepchildren is found among Hispanics. But at the same time, they are the group with the highest proportion of married stepfathers. Generally, among cohabitors only a small proportion entered unions with stepchildren, except for African-Americans, who entered this type of union at a higher rate. The distribution of type of family by race/ethnicity is quite different for women: they were most likely to marry men without coresidential children and least likely to enter either type of union when stepchildren were involved. The prevalence of women entering unions that included stepchildren was the highest among Hispanic cohabitors.

With regard to the distribution of these types of families by men's level of education, we see that the most prevalent type of union is marital without stepchildren. Eleven percent of those without a high school degree are in cohabiting unions with stepchildren, while 9% of those with a high school diploma are in marriages with stepchildren. Generally, the more educated respondents show higher proportions of marital unions versus cohabiting unions, which is consistent with current research on the socioeconomic disparities in entry into marital unions (Cherlin 2004; Waite 2005). For women, education has a similar effect; most women are much more likely to form unions with men without coresident children, and more educated women are more likely to form marital unions over cohabiting unions.

Lastly, when I compared the LMA sex ratio across the family formation outcomes, I found that the mean sex ratios are higher for men entering cohabitations or marriages with stepchildren, which is consistent with the expectation of higher union rates in places where the marriage market is favorable to women.

Table 15.3 displays a summary of the LMA sex ratio effect on the different outcomes.[2] First, regarding the probability of entering a union, among men higher sex ratios are associated with a higher likelihood of forming either type of union relative to staying single, but these effects are only marginally significant. For women, the direction of the coefficients is also positive but not statistically significant. When we move onto estimating the effect of sex ratios on the type of family individuals formed, we see that the only significant effects are for men, and that higher sex ratios are associated with lower probabilities of cohabitation without stepchildren, and higher probabilities of cohabitation with stepchildren relative to entering a marital union. The effect of LMA sex ratios is not significantly different for men marrying. Lastly, after accounting for partner characteristics, the effect of the LMA sex ratio becomes significant for women. Men in LMAs where there are large numbers of men continue to be less likely to cohabit or to marry with stepchildren, relative to marrying without stepchildren. This is consistent with the idea that men in marriage markets with a scarcity of women are more likely to marry rather than to cohabit, although we would expect that marrying single mothers would also be more likely

[2] See Appendix for the tables with the full results of the first two models summarized in Table 15.3. To avoid repetition, the discussion on individual and partner characteristics presents the results of the full model that adds partner/spouse characteristics.

Table 15.3 Summary of LMA sex ratio effect on family formation outcomes

	LMA sex ratio	
	Men	Women
Model 1. Probability of entering a union		
Staying single (reference)		
Cohabiting union	0.814+	0.204
Marital union	0.804+	0.090
N	1369	2387
Model 2. Type of family entered		
Married without stepchildren (reference)		
Cohabiting without stepchildren	−2.219***	0.376
Cohabiting with stepchildren	0.425*	−1.520
Married with stepchildren	−0.465	0.651
N	572	721
Model 3. Adds controls for partner/spouse characteristics		
Married without stepchildren (reference)		
Cohabiting without stepchildren	−2.597***	1.651*
Cohabiting with stepchildren	−0.736	−15.587**
Married with stepchildren	−1.554+	0.544
N	468	491

Source: NSFH1 (1987–1988), NSFH2 (1992–1994), 1990 Census. Weighted data
***$p < 0.001$, **$p < 0.01$, *$p < 0.05$, +$p < 0.1$
Estimates from full models that account for individual and social learning characteristics

in LMAs with fewer women. For women, cohabitation with stepchildren is very rare, while they are more likely to enter cohabitations without stepchildren once we account for the characteristics of the partner.

To better illustrate the effect that LMA sex ratios have on the probability of forming different types of families, Figs. 15.1 and 15.2 depict adjusted predicted probabilities for each outcome, holding all other covariates constant. As seen in the model coefficients, the effects of LMA sex ratios are more pronounced for men. The predicted probabilities entering unions with stepchildren are the lowest, but they do vary with the availability of men in the LMA. Men are also more likely to marry without stepchildren when the LMA has a greater availability of men. On the contrary, the probabilities of cohabiting with a woman without children decline as the availability of men increases in the LMA. Compared to men, the probabilities for women of family formation do not vary greatly across the LMA sex ratio values; the predicted probabilities of entering a union with a single father are very low and mostly constant across LMA sex ratio values. A greater deal of the variation is related to unions without stepchildren, as unions with single parents are relatively less common.

I conclude from the results of the LMA sex ratio effects that the marriage market has some effect on the type of union entered, though the effects are not large when

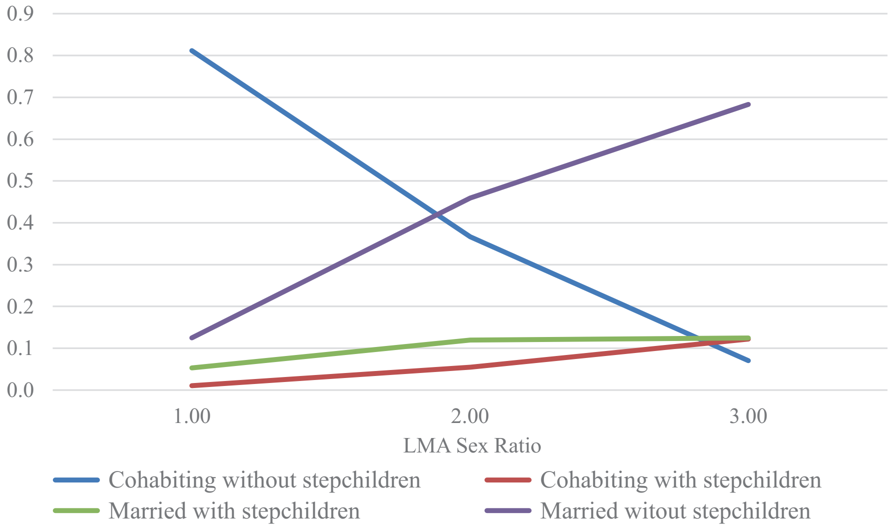

Fig. 15.1 Predicted probabilites of union formation by LMA sex ratio for men. (Source: NSFH1 (1987–1988), NSFH2 (1992–1994), Census)

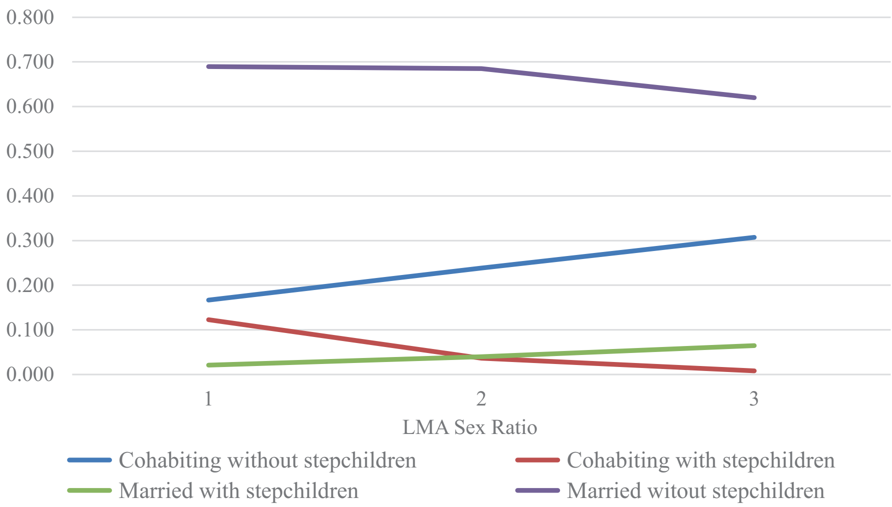

Fig. 15.2 Predicted probabilites of union formation by LMA sex ratio for women. (Source: NSFH1 (1987–1988), NSFH2 (1992–1994), Census)

considering stepfamilies. Also, the effects are more significant for men than for women. An exploration of the predicted probabilities by LMA sex ratio shows some nuance to these effects. When there are more men in the marriage market, they are significantly less likely to enter cohabitations without stepchildren relative to marrying. Women on the other hand, are much less likely to enter cohabiting unions with stepchildren, but in marriage markets that are advantageous to women, they are more likely to enter cohabitations without stepchildren. These findings provide only mixed support for the marital selectivity hypothesis.

The model in Table 15.4 is the full model that controls for individual, social learning, contexts and partner/spouse's characteristics. Some of the main differences are related to the effects of race and ethnicity, Hispanic men are more likely to enter marital unions with stepchildren and cohabiting unions without, while NH-Black men are not statistically different from NH-White men. In contrast, Hispanic women are less likely to enter marital unions with single fathers, or cohabiting unions without children, relative to entering marriages without stepchildren. NH-Black women were less likely to cohabit with a man who had coresidential children. For both sexes, age is positively related to the likelihood of entering unions where stepchildren are present.

In terms of socioeconomic status, my results show that the men cohabiting or marrying mothers are for the most part not significantly different from the men marrying childless women, and this effect exists even after accounting for the characteristics of the partner. These findings are important because they provide support for the idea that mothers will look for the best available partners and not necessarily settle for the least desirable men in the marriage market. This effect holds even after accounting for the LMA sex ratio. On the flipside, women cohabiting with single fathers are less likely to be college educated, and those marrying single fathers are less likely to be employed full time. This finding indicates that independent of the availability of suitable partners, women's characteristics do influence their outcomes in the marriage market.

The results overall show that there is a preference to enter a union with childless partners among men and women who are entering a union for the first time; the log odds of forming stepfamilies are significantly lower, especially so in the case of marital unions. Further, custodial fathers are marginally more likely, and custodial mothers are less likely, to form cohabiting unions without stepchildren as opposed to marrying with no stepchildren. However, contrary to what I expected, there is no significant difference in the risk of entering stepfamilies if the respondent has coresidential biological children, relative to the reference category. This means that coresident fathers and mothers are equally likely to enter a union with stepchildren as they are to enter a marriage without them.

Regarding the effects of partners or wives' characteristics, I show that men and women are significantly less likely to enter cohabitations, both with or without children, with partners who have some college education. We also see that older women

Table 15.4 Parameter estimates of the probability of family formation by union type, stepfamily status, and partner characteristics

	Men			Women		
	Cohabiting without stepchildren	Cohabiting with stepchildren	Married with stepchildren	Cohabiting without stepchildren	Cohabiting with stepchildren	Married with stepchildren
	vs. Married without stepchildren			vs. Married without stepchildren		
Individual characteristics						
Age [a]	−0.045	−0.113*	−0.160***	0.013	0.199+	−0.122*
Race/ethnicity (Ref: NH-white)[a]						
NH-black	1.000	0.868	0.079	0.418	−8.094**	1.658
Hispanic	3.018***	0.870	2.611*	−2.774*	−2.229	−25.331***
Education (Ref: < HS)[a]						
High school	0.429	0.291	0.731	−0.367	2.930	0.741
Some college	−0.099	−0.500	−0.160	−0.305	2.157	0.646
College graduate	0.098	−0.102	0.490	−0.700	−21.997***	1.739
Employed full-time	−0.333	−0.484	0.256	0.020	−0.407	−1.134+
Earnings (logged)	0.038	0.047	−0.054	−0.063	−0.049	−0.029
Social learning characteristics						
Two-parent biological family[a]	−0.020	−0.673	−0.307	−0.185	4.338*	0.394
Never married[a]	−0.115	−1.641*	−28.535***	−0.695+	−0.725	−27.474***
Coresidential biological children[a]	0.813+	0.322	−0.499	−0.592+	0.384	−0.353
Contextual characteristics						
Labor market area sex ratio[b]	−2.597***	−0.736	−1.554+	1.651*	−15.587**	0.544
Partner/spouse characteristics						
Age	0.094**	0.117*	0.171***	−0.014	−0.102	0.065+

Race/ethnicity (Ref: White non-Hispanic)						
Black non-Hispanic	−1.245	1.002	0.578	0.890	3.813+	−0.727
Hispanic	−0.276	0.873	0.311	0.875	2.424+	−0.541
Other non-Hispanic						
Education (Ref: < HS)	−0.356	−0.881	−0.836	−0.328	−2.115*	1.652
High school	−1.574**	−1.287	−1.023	−0.772+	−26.794***	2.508*
Some college	−0.334	−2.651**	−0.896	−0.457	−25.757***	1.173
College graduate	−0.645+	0.002	−0.451	0.025	−0.180	1.761
Constant	1.188	0.155	2.331	−1.533	10.834+	−5.179*

Source: NSFH1 (1987–1988), NSFH2 (1992–1994), 1990 Census. Weighted data. N = 468 men and 491 women

***$p < 0.001$. **$p < 0.01$. *$p < 0.05$. +$p < 0.1$

[a]Measured NSFH1

[b]Measured in 1990

are more likely to have entered unions with stepchildren relative to marital unions without children. Minority women are more likely to enter cohabitations with single fathers, although these effects are only marginally significant. This provides support for marital search explanations, since the characteristics and socioeconomic status of the potential partner were significant determinants of family formation across the board. However, contrary to expectations, single mothers did not marry the lowest quality men. Given the effect of partner's age, it is possible that women with children might wait to enter unions until they find an adequate partner, and they do not seem to be comparatively less desirable partners than other women.

15.8 Discussion and Conclusion

The research I have presented in this chapter incorporates marriage market conditions into the study of stepfamily formation. The results show only partial support for the influence of marriage market characteristics on union formation; and these effects are only consistent and significant for men. There exists also only minor support for the marital search perspective. I have shown that the education of partners is related to the probability of entering marital unions instead of cohabiting unions. For men, partner's age positively influences entering unions other than marriage without stepchildren. These findings make an important contribution to our understanding of how these two perspectives interact to influence affect family formation and help advance our understanding of the factors that should be accounted for when exploring the characteristics of those who transition into becoming stepparents.

The findings of my research suggest that marriage market conditions indeed affect family formation outcomes, although not in ways consistent to our expectations. The sex ratio measure had a negative marginal effect on the probability of forming a marital stepfamily only for men; however, the effect for cohabiting stepfamilies follows the expected direction as the likelihood is not significantly different than that of the reference group. For women, sex ratios were not related to the probabilities of forming marital unions, the higher availability of men in the LMA was related to lower probabilities of entering cohabiting stepfamilies and higher probabilities of entering cohabitations that did not include stepchildren. This is consistent with Guzzo's (2016) research that suggests that cohabitors with prior children are similar to childless cohabitors in the sense that they are also trying to figure out where their new relationship is heading before considering further commitment. Further research is needed to disentangle this effect. But my research establishes the relevance of sex ratios to better understand the formation of different families, and it suggests that future work account dealing with marriage market composition is needed to better understand the role of context on stepfamily formation.

Regardless of the availability of men to women, and consistent with the marital search perspective, individual characteristics have a strong association with union formation choice; a majority of men (76–96% depending on their race) and women (52–98%) in the sample married within their own race. Thus it makes sense that race/ethnicity was an important determinant of marriage and cohabitation with stepchildren. Men favor racially homogamous unions but not necessarily in educational terms. In my analysis 43% of the men married women of their same education, and one-third married women less educated than themselves. Educational homogamy for women followed a similar pattern.

The results also point to the importance of considering union histories to deal with some of the limitations of this research. The men and women in the sample were at a much lower risk of entering a stepfamily arrangement if that union was their first. Future research should explore more closely the relationship between stepfamily formation and higher order unions. Furthermore, marital histories would also help deal with an issue that my research was unable to include, namely the delay in union formation due to the process of marital search. As already mentioned, it is possible that some single mothers and fathers may prefer to defer union formation until they can find a partner with more desirable characteristics. By studying union histories and timing, we might be able to learn more about these processes. An analysis using life histories or multiple-wave longitudinal data with geographic information would improve the present research because it would give us the opportunity to account for changes in sex ratios over time instead of at one point in time.

The use of histories can also help account for issues such as multi-partnered fertility and multiple-union status changes overtime. Using LMAs is a convenient and robust way to model marriage markets, especially for the period covered by these data. Future research needs to account for the effects of online dating on the definition of local marriage markets. Another change that current data would need to reflect is the role of intermarriage both among races/ethnicities and between immigrants and U.S. natives. Also, analyses need to be better able statistically to incorporate the employment of contextual variables, i.e., those dealing with the LMAs. In the present research I disaggregated the contextual variables down to the level of the male and female respondents. Future research needs to introduce a more statistically appropriate multilevel modeling approach, such as hierarchical linear and nonlinear modeling.

Appendix

Table 15.5 Parameter estimates of the probability of family formation by union type

	Men		Women	
	Cohabitation	Marriage	Cohabitation	Marriage
	vs. Staying single		vs. Staying single	
Individual characteristics				
Age[a]	−0.040∗∗	−0.056∗∗∗	−0.096∗∗∗	−0.093∗∗∗
Race/ethnicity (Ref: NH-white)[a]				
NH-black	0.086	−0.721∗∗	−0.618∗	−1.140∗∗∗
Hispanic	0.149	−0.954∗	−0.391	−0.434
Education (Ref: < HS)[a]				
High school	0.071	0.151	−0.362	0.249
Some college	−0.306	0.112	−0.385	0.214
College graduate	0.161	0.505+	−0.713+	0.312
Employed full-time	0.21	0.521∗	0.282	0.213
Earnings (logged)	0.011	−0.026	−0.004	0.060∗
Social learning characteristics				
Two-parent biological family[a]	−0.036	0.302	0.188	0.085
Never married[a]	−0.28	−0.599∗∗	−0.666∗∗∗	−0.02
Coresidential biological children[a]	0.378	−0.427∗	−0.07	0.374∗
Contextual characteristics				
Labor market area sex ratio[b]	0.814+	0.804+	0.204	0.090
Constant	−1.631+	−0.136	1.272+	0.907

Source: NSFH1 (1987–1988), NSFH2 (1992–1994), 1990 Census. Weighted data. N = 1369 men and 2387 women

∗∗∗$p < 0.001$, ∗∗$p < 0.01$, ∗ $p < 0.05$, + $p < 0.1$

[a]Measured NSFH1

[b]Measured in 1990

Table 15.6 Parameter estimates of the probability of family formation by union type and stepfamily status

	Men			Women		
	Cohabiting without stepchildren	Cohabiting with stepchildren	Married with stepchildren	Cohabiting without stepchildren	Cohabiting with stepchildren	Married with stepchildren
	vs. Married without stepchildren			vs. Married without stepchildren		
Individual characteristics						
Age[a]	0.012	0.005	−0.025	−0.005	0.006	−0.031
Race/ethnicity (Ref: NH-White)[a]						
NH-black	−0.206	1.706***	0.534	0.593+	−0.135	0.884
Hispanic	2.179***	1.300+	2.190*	−0.241	2.567**	−0.993
Education (Ref: < HS)[a]						
High school	−0.069	0.093	0.548	−0.537	1.009	1.257
Some college	−0.657	0.014	0.378	−0.495	−0.004	1.269
College graduate	−0.468	−0.641	0.099	−0.917*	−24.051***	0.921
Employed full-time	−0.194	−0.546	−0.069	0.021	−0.654	−1.018*
Earnings (logged)	0.061	−0.041	−0.031	−0.058+	−0.145	−0.022
Social learning characteristics						
Two-parent biological family[a]	−0.142	−0.974*	−0.282	0.045	3.462**	0.651
Never married[a]	−0.370	−1.125+	−28.235***	−0.828**	−1.138	−27.207***
Coresidential biological children[a]	0.483	0.508	−0.596+	−0.527*	0.141	−0.758+
Contextual characteristics						
Labor market area sex ratio[b]	−2.219***	0.425*	−0.465	0.376	−1.520	0.651
Constant	1.811	−1.028	1.593	0.158	−3.830	−2.253*

Source: NSFH1 (1987–1988), NSFH2 (1992–1994), 1990 Census. Weighted data. N = 572 men and 721 women

*** $p < 0.001$, ** $p < 0.01$, * $p < 0.05$, + $p < 0.1$

[a]Measured NSFH1

[b]Measured in 1990

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Chapter 16
Minority Student Participation in International Programs

Komanduri S. Murty

16.1 Introduction

The increasing focus on international education among postsecondary administrators and policymakers in recent decades has resulted in considerable growth of student-participants in study abroad programs (Friedman 2005; Green et al. 2008; Institute of International Education 2017; Lincoln Commission 2005), and of student-enrollments in foreign languages (Brod and Huber 1997; Furman et al. 2010; Huber 1992). The transformational powers and effects of international education are frequently observed to manifest themselves in higher college completion and graduation rates (e.g., O'Rear et al. 2012; Redden 2012; Sutton and Rubin 2010) and in such functional aspects as self-efficacy, personal growth, global awareness, cultural awareness, intercultural adjustment, cross-cultural communication, and foreign language skills (e.g., Black and Duhon 2006; Carlson et al. 1990; Doyle 2009; Hadis 2005; Ingraham and Peterson 2004; Savicki et al. 2004). However, 80% or so of those who participate in study abroad programs are White and upper middle class (Brux and Fry 2010). There is a gross underrepresentation in study abroad programs of Black students and students of other racial/ethnic minorities, as well as those of low socioeconomic status (Penn and Tanner 2009; Simon and Ainsworth 2012).

A recent report by the National Association for Foreign Student Affairs (NAFSA 2017) shows that the underrepresentation of minority students in study abroad programs continues to exist even in the 2015–2016 academic year (Table 16.1). The underlying factors for such stark differences appear to be the high cost of the programs and insufficient financial aid (Lambert 1989), lack of support from faculty

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Table 16.1 Percent of U.S. Study abroad students by race/ethnicity

Race/ethnicity	U.S. Postsecondary enrollment, 2015–2016	U.S. Students abroad, 2015–2016
African American/Black	14.1%	5.9%
Asian/Pacific Islander	6.8%	8.4%
Caucasian	57.6%	71.6%
Hispanic/Latino American	17.3%	9.7%
Multiracial	3.5%	3.9%
American Indian/Alaska Native	0.8%	0.5%

Source: NAFSA: Association of International Educators (2017). *Trends in U.S. Study Abroad.* Washington DC: NAFSA. https://www.nafsa.org/Policy_and_Advocacy/Policy_Resources/Policy_Trends_and_Data/Trends_in_U_S__Study_Abroad/. Accessed 7 July 2018

(Paus and Robinson 2008) and/or family (Dessoff 2006), limited access to information and peer networks (Brux and Fry 2010; Mattai and Ohiwerei 1989), restricted program options (Brux and Fry 2010; Carter 1991), fear of racism (Abu 2015), and the general perception among Black students that study abroad is more a luxury than an educational enhancement (Dessoff 2006).

Surprisingly, few studies have focused on minority students' attitudes, especially those attending Historically Black Colleges and Universities (HBCUs), regarding their participation in international education activities and/or study abroad programs. The purpose of this chapter is to highlight the findings of the national United Negro College Fund Special Programs (UNCFSP) web-based minority undergraduate student survey conducted in 2007, with funding from the U.S. Department of Education. The survey focused on (a) attitudes of minority undergraduate students attending HBCUs toward existing international education activities and programs, and (b) factors promoting or hindering their participation in such activities and programs. A total of 1346 students from 62 HBCUs completed the survey.

16.2 Review of Literature

The relevant literature reveals that international education, i.e., training in foreign languages, integrated cross-cultural curriculums, focused majors, internships through global partnerships, and international exchange programs, as well as study abroad programs, have become a vital part of higher education in the United States as well as in other countries (Altbach 2006; Bellamy and Weinberg 2006; Brustein 2007; Cornwell and Stoddard 1999; Green and Barblan 2004; National Association of State Universities and Land Grant Colleges Task Force on International Education 2004).

Qiang (2003) observed the importance of preparing globally competent students through a strategic internationalization of education by adopting necessary organizational factors, e.g., policy statements, annual planning, and review systems, and academic activities, e.g., student/faculty exchanges, curriculum, and recruiting/hosting international students. Specific benefits associated with international education include personal development, academic commitment, intercultural development, and career development (Adler et al. 2005; Black and Duhon 2006; Bohrer 2016; Dwyer and Peters 2004; Schworm et al. 2017; Wanasek 2005).

A study conducted by the National Association for Foreign Student Affairs (NAFSA) in 2006 to assess public attitudes towards international education revealed that most respondents agree that (1) it is important to prepare future generations of Americans for a global society; (2) knowledge of other languages will give future generations a competitive advantage in career opportunities; (3) it is important for future generations to participate in study abroad programs while in college, where they can spend time living and studying in another culture; and (4) it is important for future generations to have knowledge of other countries and cultures (NAFSA 2006).

Despite these positive public attitudes and perceived benefits, many students tend not to participate in international education and study abroad programs. In fact, the Institute of International Education's (2017: para 12) *Open Doors 2017 Executive Summary* states the following about the participation of U.S. students studying abroad:

> Although the total number is at an all-time high, it is still the case that only about 10 percent of all U.S. undergraduate students (including community college students) will study abroad by the time they graduate. The fact that 90 percent of all American undergraduate students enrolled in U.S. higher education are graduating without an international experience means that there is still a long way to go. For students pursuing a Bachelor's degree, approximately 15.5% studied abroad before graduating.

Stroud (2010) studied factors contributing to student participation in study abroad programs drawing on data from an annual survey of 2258 full-time freshmen entering the University of Massachusetts-Amherst, a large, predominantly White, public northeastern university that participated in the 2007 Cooperative Institutional Research Program (CIRP) survey. Her findings disclosed that females, attending school more than 100 miles away from home, and with a desire to improve self-understanding of other cultures and countries are more likely to participate in study abroad programs than are males, living with family while attending school, and majoring in engineering or other professional areas like architecture or medicine.

In an earlier analysis, Booker (2001) examined differences pertaining to the decision to study abroad of applicants and non-applicants at a large, public, mid-western university and found that applicants tend to be less reliant on financial aid and employment to attend college, whereas non-applicants tend to be more influenced by factors related to academic and financial concerns.

Salisbury et al. (2009) explored the impact of financial, human, social, and cultural capital on students' intentions to study abroad by utilizing data collected from 2772 students enrolled at 11 participatory liberal arts colleges in the Wabash National Study on Liberal Arts Education (WNSLAE). Their analysis revealed that (1) insufficient financial capital significantly hinders the likelihood of participation in study abroad; (2) the level of parents' education is positively associated with the probability of planning to study abroad; (3) males are less likely to intend to study abroad than females; (4) the relatively low participation of African American and Latino's in the study abroad may not be due to a lack of desire, since they do not differ from Whites in their intent to study abroad; (5) students with a greater interest in reading and writing, open to diverse ideas and people, and majoring in the social sciences, are more likely to plan to study abroad than others; and (6) community college students are less likely to intend to study abroad than those at liberal arts colleges.

16.3 International Education at Historically Black Colleges and Universities (HBCUs)

HBCUs were among the first American colleges to develop international focuses. For example, during the 1880s, Storer College taught rudimentary language skills in various Congolese languages in order to prepare students for missionary work. In the late nineteenth century, under the aegis of Booker T. Washington, Tuskegee sent agricultural experts to Togo to research and develop ways to increase cotton production. Moreover, HBCUs were in the forefront at providing undergraduate education to such African leaders and other professionals as Kwame Nkrumah, Nnamdi Azikiwe, James Thaele, and C. Cecil Denis (Lincoln University, Pennsylvania); Angie Brooks (Howard University); and Ellen Mills Scarborough (Shaw University). HBCUs like Hampton and Tuskegee became academic models for various countries in Africa and the Caribbean. Marcus Garvey, in his Black Nationalist movement made numerous visits to Tuskegee and attempted to replicate their system in his native country of Jamaica and in Africa. Likewise, Reverend James Henderson also hoped for an "interracial association" in South Africa modeled on Tuskegee in the mid-1920s (Veney 2002; Rich 1987).

Although Howard University taught Swahili in the 1920s, Rivers (1933) has documented that French, German, Spanish and Italian were the most commonly taught languages at HBCUs, but that students were not provided with opportunities to study abroad. Nyabongo (1946) conducted a survey of the number of faculty teaching foreign languages, the number of students enrolled in foreign language classes, and the language teaching method used during the period 1942–1944. Although his research showed an increased interest and enrollment in foreign language courses at HBCUs, it he noted that little attention was paid to measuring and evaluating foreign language teaching and learning at HBCUs.

A 1953 study by Miller on HBCU campuses found that teaching methods were an obstacle to greater competence in language acquisition among students at HBCUs, but they were not an obstacle to participation in language study (Miller 1953). LeBlanc (1972) studied foreign language programs at HBCUs and found that HBCU students felt that language study would be more relevant if it was specifically related to their academic majors. The students also expressed a desire to develop fluency in the languages they studied. Davis and Markham (2008) conducted research on student attitudes toward foreign language study at 53 historically and predominantly Black institutions; 57 administrators, 50 language faculty, and 810 students participated in the study. The researchers concluded that student respondents perceived foreign language study as being less threatening to their own cultural identity. Moreover, they demonstrated a greater awareness of the career benefits of foreign language study. On the other hand, their dissatisfaction stemmed from the limited development of speaking ability, the lack of emphasis on cultural information, particularly conferring the Black experience in the target language culture, the limited amount of attention given to addressing individual students' needs and learning styles, and the restricted amount of time allowed for mastering the new language material.

Walker et al. (2011) examined students' perceptions of globalization and study abroad programs using data from self-reported surveys of 263 undergraduate minority students enrolled in Fall 2008 at Alabama A&M University. Their findings show that (1) nearly two-third of the student respondents agreed that taking a course in global studies would increase their chances of getting a job or a better job upon completion of their undergraduate education; (2) an overwhelming majority agreed that university professors are the most useful source of information; (3) the skepticism about globalization tended to increase with the level of education; and (4) students majoring in business tended to be more favorable toward globalization than non-business majors.

In sum, a great deal of the literature on international education and study abroad programs has focused on large, predominantly White, and public institutions. Only a few studies have attempted to examine minority student participation or their intent to participate in those programs. Their number is even smaller when minority student participation in international education at HBCUs is considered, and their focus is largely confined to foreign language programs or foreign language studies. Therefore, the research we present in this chapter will fill gaps in two broad areas: first, its specific focus is on minority students attending HBCUs; second, it explores students' attitudes as well as obstacles related to students' participation in various international education activities specific to HBCUs, including foreign language study, study abroad, educational exchanges, and perceptions of institutional policies.

16.4 Methodology

16.4.1 Population and Sample

The population examined in our research consisted of all minority undergraduate students attending HBCUs at the time of the survey. There were 103 HBCUs dispersed through 20 U.S. states, the District of Columbia, and the U.S. Virgin Islands. Moreover, 100 of them have undergraduate study programs. The minority undergraduate students enrolled at these 100 institutions constituted the sample frame. A self-selection sample technique was adopted by inviting all minority students in the sample via campus liaisons, advertisements through broadcast email to faculty and students at target institutions, and advertisements in the UNCFSP newsletter. These methods yielded responses from 1346 students attending 62 HBCUs; these consisted of 33 (53.2%) 4-year public institutions, 28 (45.2%) 4-year private institutions, and one (1.6%) 2-year public institution.

16.4.2 Survey Design

A student survey was designed by selecting relevant questions from an American Council of Education (ACE) study conducted by Hayward and Siaya (2001); extra questions were added appropriate to the study objectives. The final survey contained four sections: (1) Background, (2) General Attitudes and Abilities, (3) Formal International Education and Travel Experiences, and (4) Informal International Travel Experiences. The survey was published online on April 12, 2007; hard copies of the survey were also mailed to and retrieved from campus liaisons to increase student participation on technologically challenged campuses with clear instruction that they needed to complete only one format. Data collection continued through May 21, 2007, or for about 40 days.

16.5 Analysis

A total of 1346 undergraduate students from 62 Historically Black Colleges and Universities (HBCUs) participated in the survey. Figure 16.1 shows the levels of participation; 100 or more students per institution participated from four institutions, 51–99 students each from another four institutions, 25–50 students each from nine institutions, 10–24 each from another nine institutions, and less than 10 students per institution participated from 36 institutions.

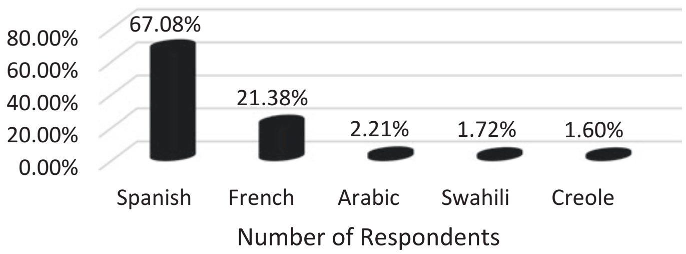

Fig. 16.1 Participating HBCUs by number of respondents

16.5.1 Sociodemographic Characteristics of the Study Respondents

Seventy percent of the undergraduate respondents were in the traditional college-age-group of 18–22 years, followed by approximately 19% in the ages of 23–27 years. Eleven percent of the students were clearly non-traditional students, with reported ages of 28 years or older (see Table 16.2). Regarding gender, 72% of the respondents were females and the remaining 28% were male students. An overwhelming number of respondents (92.9%) identified themselves as Black or African American, followed by White (4.6%), American Indian or Alaska Native (3.7%), and Asian (1.4%). Only 6 respondents (0.4%) identified themselves as Native Hawaiian or Pacific Islander, and 55 respondents (4.1%) did not disclose their racial identity.

Although many students were reportedly raised in urban (37.6%) and inner-city (28.3%) areas, 19.2% were raised in rural non-farm areas, and another 7.9% in rural-farm neighborhoods. Nearly one-half (47.8%) of the respondents were first generation college students. Almost all respondents (96.6%) knew their current classification. Freshmen, sophomores, and juniors were found to have been distributed equally around 20% each, senior students responded in a considerably higher number (35.1%).

With respect to major areas of study, Social Sciences (27.8%) and Business Administration (18.7%) were the most frequently reported, and English (2.8%) and Agricultural Sciences (2.7%) were the least frequently reported. As for academic performance, many students reportedly performed well: 24.9% maintained cumulative GPAs from 3.5 to 4.0 on a 4-point scale, 33.3% between 3.0 and 3.49, and 28.1% between 2.5 and 2.99. Only 24 of the 1346 respondents (1.8%) reported low GPAs; that is, less than 2.0. Overall, 58.2% reported cumulative GPAs of above 3.0, and 86.3% above 2.5.

As expected, we found that many of the minority students at HBCUs do not come from economically affluent backgrounds. Less than one-third (29.8%) stated they received some kind of partial or total parental support. Most depend on multiple funding sources to pursue their postsecondary education. Federal Financial Aid was the leading category of financial support (69.9%), followed by Pell Grants (50.9%) and Stafford Loans (44.8%). These are the financial loan liabilities that follow them after graduation. Either because of the fear of these continuing fiscal burdens or because of the inadequate support from these loans, 12.1% reportedly worked full-time and another 31.6% worked part-time to defray their educational costs. Given the fiscal constraints and limited resources that the HBCUs constantly face, it is not surprising that only 43.1% of the respondents reportedly received some form of Institutional Grant or Scholarship. Finally, most students (97.2%) did not report any physical restrictions, impairments or allergies that would limit their participation in international programs and activities (Table 16.2).

Table 16.2 Distribution of respondents by sociodemographic characteristics

Variable	Number	Percent
Age (N = 1346)		
17 years	3	0.2
18 years	134	10.0
19 years	204	15.2
20 years	216	16.0
21 years	219	16.3
22 years	166	12.3
23–27 years	250	18.6
28+ years	154	11.4
Gender (N = 1346)		
Male	379	28.2
Female	967	71.8
Race/Ethnicity (N = 1346)		
Black or African American	1251	92.9
White	62	4.6
American Indian or Alaskan Native	50	3.7
Asian	19	1.4
Native Hawaiian or Pacific Islander	6	0.4
Not Reported	55	4.1
Primary Area Where Raised (N = 1346)		
Rural/Farm	107	7.9
Rural/Non-Farm	259	19.2
Urban	506	37.6
Inner-city	381	28.3
Other	93	6.9
First Generation College Student (N = 1346)		
Yes	643	47.8
No	703	52.2
Classification (N = 1346)		
Freshman	272	20.2
Sophomore	273	20.3
Junior	282	21.0
Senior	473	35.1
Unclassified/Don't know	46	3.4
Major (N = 1, 058)		
Social Sciences (psychology, criminology, political science, social work, or sociology)	294	27.8
Business Administration (Accounting, Finance, Marketing, or Management)	198	18.7
Biological/Life Sciences or Pre-medicine	131	12.4
Education	129	12.2
Journalism or Communications	82	7.8

(continued)

Table 16.2 (continued)

Variable	Number	Percent
Public Health, Allied Health, and Related Sciences	58	5.5
Computer/Information Science	54	5.1
Engineering	53	5.0
English	30	2.8
Agricultural and Related Sciences	29	2.7
Current Cumulative GPA (N = 1346)		
3.5–4.0	335	24.9
3.0–3.49	448	33.3
2.5–2.99	378	28.1
2.0–2.49	161	12.0
Less than 2.0	24	1.8
Source(s) of Funding for Education (N = 1346)		
Federal Financial Aid	941	69.9
Institutional Aid	580	43.1
Full-time employment	163	12.1
Part-time employment	425	31.6
Parental Support	401	29.8
Pell Grant	685	50.9
Stafford Loan	603	44.8
Other	190	14.1

16.5.2 General Attitudes and Abilities

Respondents were asked to rate the “importance” of knowledge and skills in three specific areas, namely, foreign language, other cultures/customs, and international issues/events, that would enable them to compete successfully in the job market. Around two-thirds of the students responded that it is very important to “understand other cultures and customs” (68.7%) and to know “about international issues and events” (62.3%). In addition, over one-fourth thought that these abilities play a somewhat important role in their success. On the other hand, only 38.6% felt that “speaking a foreign language” is a very important skill to have in order to successfully compete in the job market, and 44.4% perceived it to be somewhat important (Table 16.3).

We found that female students are significantly more likely to have positive attitudes toward these international educational aspects than male students. This may explain, at least in part, the higher level of female participation in study abroad programs compared to male students at several postsecondary U.S. institutions. For example, Bush and Madden (2006: para 4) have written that:

> …Yale Daily News reported that 75 percent of Yale students studying abroad in 2006 were female. The Dartmouth reports a similar two-to-one female-to-male ratio among students going abroad from Dartmouth College, the same as the national average. Anecdotally, students from Fordham Univ., the Univ. of Denver, the College of William and Mary, and the State Univ. of New York all report parallel experiences.

Table 16.3 Percent distribution of respondents by perceived importance of international education (n = 1346)

International education aspects	Very important	Somewhat important	Not important	No opinion
1. To speak a foreign language[a,]	38.6	44.4	14.0	3.0
2. To understand other cultures/ customs[a]	68.7	25.9	3.9	1.6
3. To know about international issues/ events[a]	62.3	30.8	5.3	1.6

Note: [a] = response patterns differed significantly ($p \leq 0.05$) by gender

In addition, the perceived level of importance to "speak a foreign language" is consistent with contemporary foreign language requirements in higher education. For example, Helms et al. (2017:15) reported that in 2016, 46% of institutions were having a foreign language requirement (for undergraduate) graduation, of which 17% required it for all students, and 29% did so for some students.

Table 16.4 presents data on the percentage distribution of respondents by degree of agreement with respect to ten different international education curriculum aspects and benefits. It is shown that less than one-half of the students either strongly agreed or somewhat agreed with such beliefs that "the more time spent in class learning about other countries, cultures, or global issues, the less time is available for the basics" (44.2%); and that "learning about other countries, cultures, and global issues is useful, but not a necessary component of my education" (38.7%). Males more frequently than females, and students raised in rural areas rather than in urban/ inner-city areas, tend to hold such beliefs. Perhaps the greater degree of such beliefs among the students, who were raised primarily in rural areas, is due to the additional time needed for them to catch up with their peers both academically and otherwise.

Seventy-six percent of the respondents either strongly agreed or somewhat agreed that "all undergraduate students should be required to take courses covering international topics"; and, even a higher percentage (86.2%) agreed that "all undergraduate students should be required to study one foreign language if they already don't know one." The later percentage is higher than the one reported in the ACE Survey by Hayward and Siaya (2001:51) that only 71% of the 1006 respondents strongly agreed/somewhat agreed that students in colleges and universities should be "required to study a foreign language if they don't already know one". Thus, the HBCU minority students' propensity to learn foreign language is higher than that of the overall undergraduate student population in the U.S. Also, there is a strong positive correlation ($r = 0.40$) among the minority student respondents between how important a student thinks that speaking a foreign language improves his/her chances of employability and how strongly he/she agrees that all undergraduates should know one. Females tend to be more positive about this requirement than males. Also, sophomores, juniors and seniors are more frequently in support of it than freshmen. Both these differences were statistically significant.

Further, an overwhelming majority of the respondents strongly agreed or somewhat agreed that studying international topics, foreign languages, and visiting other

Table 16.4 Percent distribution of respondents by degree of agreement with international education aspects and benefits (n = 1346)

International education curriculum aspects & benefits	Strongly agree	Somewhat agree	Somewhat disagree	Strongly disagree	No opinion
1. The more time spent in class learning about other countries, cultures, or global issues, the less time is available for the basics[a,b]	11.7	32.5	28.9	20.7	6.2
2. Learning about other countries, cultures, and global issues is useful, but not a necessary component of my education[a,b]	12.0	26.7	25.6	31.6	4.2
3. All undergraduate students should be required to take courses covering international topics	32.5	43.5	15.2	4.5	4.4
4. All undergraduate students should be required to study one foreign language if they already don't know one[a]	49.7	36.5	7.1	3.8	3.0
5. Studying international topics, foreign languages, and visiting other countries will increase my understanding of my own culture and values	57.8	33.0	5.1	1.4	2.7
6. Studying international topics, foreign languages, and visiting other countries will increase my understanding of other peoples and cultures[a]	73.0	23.3	1.6	0.4	1.8
7. Studying international topics, foreign languages, and visiting other countries will make me a more well-rounded person[a]	70.1	23.7	3.1	1.0	2.0
8. Studying international topics, foreign languages, and visiting other countries will help me get a better job[a]	51.9	34.0	9.6	1.6	3.0
9. Studying international topics, foreign languages, and visiting other countries will provide me with skills to work with people from diverse backgrounds[a]	74.4	21.5	1.3	0.8	1.9
10. All undergraduate students should have a study abroad experience sometime during their college or university career	42.8	38.0	9.4	4.0	5.9

Note: [a] = response patterns differed significantly ($p \leq 0.05$) by gender; [b] = response patterns differed significantly ($p \leq 0.05$) by residence countries will do the following: increase the understanding of their own culture and values (90.8%); increase the understanding of other peoples and their cultures (96.3%); make them more well-rounded persons (93.8%); help them to get better jobs (85.9%); and provide them with skills to work with people from diverse backgrounds (95.9%). Nearly 81% strongly agreed or somewhat agreed that all undergraduates should "have a study abroad experience sometime during their college or university career." This percentage is higher than the one reported in the ACE Survey by Hayward and Siaya (2001:50) that only 75% of the 1006 respondents strongly agreed/somewhat agreed that students should have a study abroad experience some time during college or university. The percentage of HBCU minority students believing that the study abroad experience is desirable during their college years is higher than the corresponding percentage of students in the general undergraduate population in the nation.

16.5.3 Foreign Language Proficiency and Ability

Nearly 95% of the participating students (n = 1278) identified themselves as U.S. Citizens. When asked whether they studied a foreign language prior to attending college, 88% replied in the affirmative, although only 11% spoke a language other than English. Only 9% came from a bilingual home; and yet, 60% could speak or read at least one language besides English, a percentage which is much higher than the ACE survey's finding by Hayward and Siaya (2001:49), which showed that only 42% could do so. Of these, 77% could speak or read one other language, 19%, two other languages, and the remaining 4%, three or more other languages. Spanish and French were the most common foreign languages reported by the HBCU students. Over one-third of the students reportedly had proficiency in Spanish, and another one-fifth in French (see Fig. 16.2).

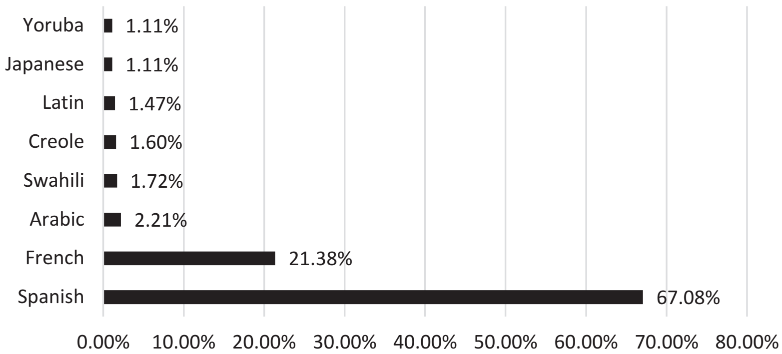

Fig. 16.2 Percentage of respondents with ability to speak or write a foreign language (at least 1%)

16.5.4 Formal International Education and Travel Experiences

Many of the students reported that they participated in one or more of the following international education programs or activities: 81% studied a foreign language; 53% completed a course on global themes; 56% took a course focused on foreign cultures/religions; 11% participated in study abroad or other international travel related to academic study; and, 9% participated in cross-cultural/cross-national research.

Thus, although the majority of these HBCU minority students maintained positive attitudes toward international education, knew its importance, participated in various international programs and activities, and reportedly had the ability to speak and/or read one or more foreign languages, only 11% traveled outside the United States for academic purposes. Of these, nearly one-half spent only one month or less, and about one-quarter spent 1–6 months outside the U.S. in programs.

Students who traveled outside the U.S. for academic purposes were mainly female, raised primarily in urban areas or inner cities, were not first-generation college students, and were senior undergraduates. For the most part, these patterns remained the same regardless of how long they stayed outside the U.S. for academic purposes.

16.5.5 Perceived Benefits After Traveling Outside the U.S. for Academic Purposes

The benefits of traveling outside the United Students for academic purposes, as perceived by those who had such an experience, were the following: (1) increased their understanding of their own culture and values; (2) increased their understanding of other people and cultures; (3) increased their foreign language skills; (4) made them more well-rounded persons; (5) increased chances of getting better jobs; and (6) provided them with skills to work with other people from diverse backgrounds (Tables 16.5 and 16.6). These perceived benefit patterns are consistent with those found in other study abroad programs (see for example, Adler et al. 2005; Black and Duhon 2006; Dwyer and Peters 2004; Ingraham and Peterson 2004; Wanasek 2005).

16.6 Conclusion

There is an extensive body of research on international education and study abroad programs. But it has focused almost entirely on students in predominantly White, large, public institutions of higher education. Few studies have focused on minority

Table 16.5 Distribution of respondents by their formal international education and travel experiences

Formal international education experiences	Number	Percent
1. Participation in International Education Programs/Activities (n = 1346):		
Studied a foreign language[a]	1091	81.1
Took a course focused on global themes	708	52.6
Took a course focused on foreign cultures/religions	757	56.2
Participated in study abroad/other international travel related to academic study	149	11.1
Participated in cross-cultural/cross-national research[a,]	119	8.8
2. Travelled outside the United States (n = 149)		
One month or less	74	49.7
1–6 months	37	24.8
6 months – 1 year	11	7.4
Over 1 Year	27	18.1
3. Countries Visited (n = 149)		
Canada	16	10.7
France	14	9.4
Mexico	11	7.4
Spain	11	7.4
Nigeria	9	6.0
South Africa	9	6.0
Costa Rica	7	4.7
Germany	7	4.7
U.K.	6	4.0
Japan	4	2.7
Kenya	4	2.7
Trinidad & Tobago	4	2.7
Other	47	31.50
4. Perceived Benefits of traveling outside the U.S. (n = 149)		
Increased understanding of own culture and values	115	77.2
Increased understanding of other peoples and cultures	126	84.6
Increased foreign language skills	88	59.1
Made a more well-rounder person	124	83.2
Increased chances of getting a better job	61	40.9
Provided skills to work with others from diverse backgrounds[a]	113	75.8
Other	39	26.2

Note: [a]response patterns differed significantly ($p \leq 0.05$) by gender

Table 16.6 Distribution of respondents by their informal international travel experiences

Informal International Education Experiences	Number	Percent
1. Travelled outside the United States (n = 521)[a]		
One month or less	355	68.1
1–6 months	71	13.6
6 months – 1 year	24	4.6
Over 1 Year	71	13.6
2. Countries Visited (n = 149)		
Canada	94	18.0
Bahamas	66	12.7
Mexico	61	11.7
Jamaica	39	7.5
U.K./England	38	7.3
Germany	23	4.4
Aruba	17	3.3
France	14	2.7
Virgin Islands	14	2.7
Haiti	12	2.3
South Africa	12	2.3
Barbados	11	2.1
Trinidad & Tobago	11	2.1
Other	109	20.9
3. Perceived Benefits of Traveling Outside the U.S. (n = 521)		
Increased understanding of own culture and values[a]	305	58.5
Increased understanding of other people and cultures	378	72.6
Increased foreign language skills[a]	164	31.5
Made a more well-rounder person	305	58.5
Increased chances of getting a better job	81	15.5
Provided skills to work with others from diverse backgrounds	224	43.0
Other	189	26.3

Note: [a]response patterns differed significantly ($p \leq 0.05$) by gender undergraduate students at HBCUs. And the limited HBCU research has dealt primarily with student enrollments in foreign language courses.

The research reported in this chapter addressed this void by examining these issues among students in HBCUs. Our research is based on the responses of 1346 students enrolled at 62 HBCUs. It is the largest analysis of minority students of which we are aware. We have analyzed data in this chapter on general attitudes and abilities; experiences and perceived benefits of formal international education; and travel outside the U.S. Where possible, we compared our results with data from the national ACE survey conducted by Hayward and Siaya (2001), so to be able to examine how the patterns of the minority students at HBCUs compare with those of the general undergraduate student population attending U.S. colleges. Overall, the minority patterns are consistent with those of the general student population.

We found that the positive attitudes of the minority students toward and their desirability to participate in international education and study abroad to be more extensive that those of students in the ACE survey. However, their participation levels are lower, likely because of high cost and conflicting schedules. Some minority students appeared to prefer completing necessary coursework for degree requirements before they could take part in some of the international and study abroad activities.

Hopefully, our research will encourage the further analysis of minority students at HBCUs, especially in the ways of increasing their participation in international education and study abroad activities, thereby reducing the disparities observed in these areas of postsecondary education.

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Chapter 17
Community Well-being and Mexican Interstate Migration in the United States

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17.1 Introduction

In this chapter we model the interstate migration flows of Mexicans in the United States in the period of 2011–2015. Our theoretical rationale and modeling are mainly grounded in sociological human ecology. Our research fills two important voids in the demographic literature analyzing migration streams. First, virtually all prior analyses of U.S. interstate migration streams have focused on the migration flows of all persons, that is, without regard to their race or ethnicity or other characteristics. Our research analyzes the migration flows of Mexicans. According to data from the annual American Community Surveys of 2011 through 2015, there were an estimated nearly 440,000 Mexicans living in one of the 49 contiguous U.S. states and the District of Columbia who had migrated to that state from another U.S. state or the District 1 year earlier. In our chapter we describe the interstate migration flows of these Mexicans, and we model the variation in their flows with a basic gravity model and with a human ecological model.

Second, with but a couple of exceptions (Karp and Kelly 1971; Poston and Mao 1996, 1998; Poston and Zhang 2008), most of the prior research analyzing interstate migration streams in the U.S. and in other countries has used spatial interaction models with a heavy focus on economic approaches and variables. A major contribution of our research in this chapter is the articulation of the ecological approach as a perspective for studying interstate migration flows. We expect that our analysis will point to the important and statistically significant influence of some state-level

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ecological factors dealing with community well-being as predictors of the size of the Mexican migration flows to and from the states.

We begin our discussion with a description of the migration streams of Mexicans among the 49 contiguous states of the U.S., including the District of Columbia, for the 2011–2015 period. This is followed by a discussion of the main migration model we use to predict variation in the internal migration streams of Mexicans, the human ecological model, which is compared and contrasted, theoretically and empirically, with the gravity model. Then, we estimate ordinary least squares (OLS) regression equations for both models to explore and contrast their effects on the interstate migration streams of Mexicans.

17.2 Measurement of Mexican Interstate Migration

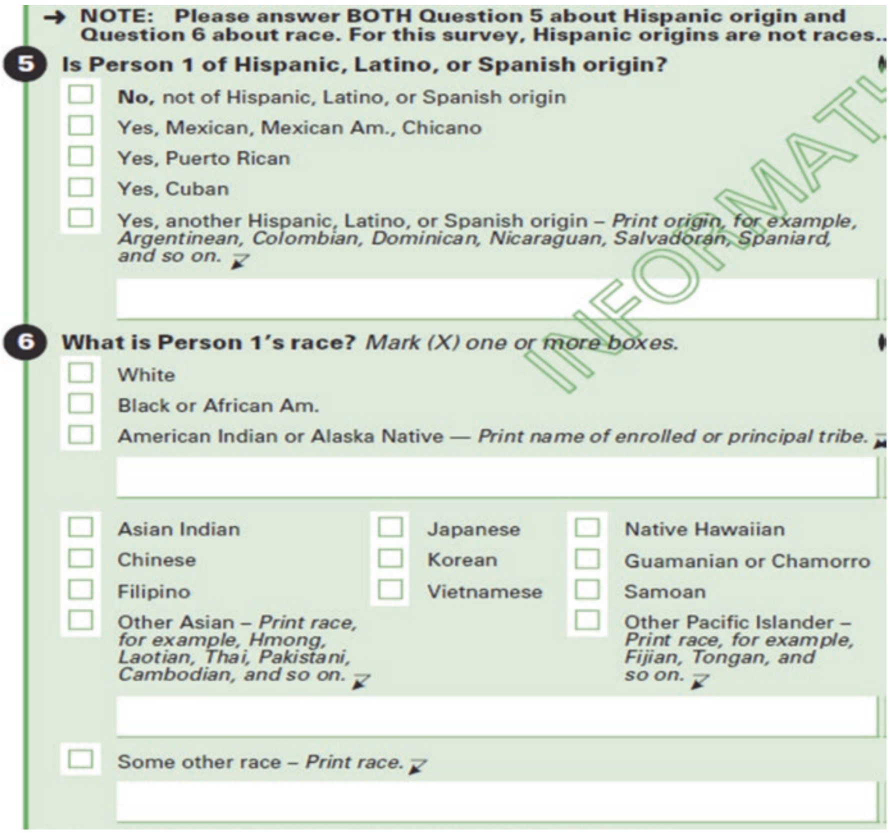
Our dependent variable is the number of Mexican interstate migrants in each of the 2352 migration streams to and from each of the 49 contiguous U.S. states (we refer to the District of Columbia as a state) during the 2011–15 time period. We define an interstate Mexican migration stream as the number of Mexicans moving between state *i* and state *j* in any one-year period during 2011–2015. We restrict our analysis to migration between any pair of the 49 contiguous states, which includes, as just noted, the District of Columbia. Thus, there is a maximum possible number of 2352 interstate migration streams (or 49 x's 48) from and to each of the 49 contiguous states including the District. We show below, however, that many of these streams have zero Mexican migrants, so they are dropped from our analysis.

The dependent variable, i.e., the size of the interstate migration stream of Mexicans, is based on sample data from the American Community Surveys (ACS) conducted annually in the years of 2011 through 2015. The ACS is an ongoing survey of the U.S. Census Bureau that provides demographic and socioeconomic information on a yearly basis for geographic areas (states, counties, census tracts, and so forth) in the U.S. The Census Bureau randomly selects about 3.5 million households in the U.S. each year to participate in the ACS via a series of monthly samples. This means that about 1 in every 38 households in the U.S. is included each year in the ACS.

The ACS estimates are based on samples of housing units and persons in the population. The ACS data are not drawn from the full population. Each sampled person in the ACS has a person-weight that indicates the total number of persons in the complete population represented by the one sampled case. In the American Community Surveys of 2011 through 2015, there were sampled over 8800 Mexicans living in one of the 49 contiguous U.S. states who had migrated to that state from another U.S. state 1 year earlier. We multiplied each of these sampled Mexicans by their person weights to obtain an estimate of the total number of Mexican interstate migrants. The over 8000 sampled Mexican interstate migrants represent about 440,000 Mexican interstate migrants in the total population. These 440,000 interstate migrants comprise the population being analyzed in this chapter.

A Mexican is a person who responds in the following way to question #5 on the American Community Survey questionnaire that asks whether the respondent is of Hispanic, Latino or Spanish origin: "Yes, Mexican, Mexican American, or Chicano." The respondent may check off any of the race responses on question #6 (see Fig. 17.1). A Mexican, therefore, is defined as a person of any race who responds that he/she is of Mexican origin.

Regarding the measurement of the dependent variable, past research indicates two principal ways to measure a migration stream between two areas: an absolute number and a rate. Some migration stream research has used the absolute number of migrants (Zipf 1946; Galle and Taeuber 1966; Greenwood 1969, 1971; Poston and Mao 1998; Poston and Zhang 2008), and other research has used rates (Karp and Kelly 1971; Greenwood and Sweetland 1972; Poston and Mao 1996). There are assets and liabilities involved in both kinds of measures. For one thing, policy decisions and adjustments are more easily determined if the outcome, i.e., the dependent variable, is the absolute number of movers. Prior research (Poston and Mao 1998; Poston and Zhang 2008) has shown that the two measures are highly correlated with


→ NOTE: Please answer BOTH Question 5 about Hispanic origin and Question 6 about race. For this survey, Hispanic origins are not races.

5 Is Person 1 of Hispanic, Latino, or Spanish origin?

- ☐ **No,** not of Hispanic, Latino, or Spanish origin
- ☐ Yes, Mexican, Mexican Am., Chicano
- ☐ Yes, Puerto Rican
- ☐ Yes, Cuban
- ☐ Yes, another Hispanic, Latino, or Spanish origin – *Print origin, for example, Argentinean, Colombian, Dominican, Nicaraguan, Salvadoran, Spaniard, and so on.*

6 What is Person 1's race? *Mark (X) one or more boxes.*

- ☐ White
- ☐ Black or African Am.
- ☐ American Indian or Alaska Native — *Print name of enrolled or principal tribe.*
- ☐ Asian Indian
- ☐ Chinese
- ☐ Filipino
- ☐ Other Asian – *Print race, for example, Hmong, Laotian, Thai, Pakistani, Cambodian, and so on.*
- ☐ Japanese
- ☐ Korean
- ☐ Vietnamese
- ☐ Native Hawaiian
- ☐ Guamanian or Chamorro
- ☐ Samoan
- ☐ Other Pacific Islander – *Print race, for example, Fijian, Tongan, and so on.*
- ☐ Some other race – *Print race.*

Fig. 17.1 Extract of the questionnaire of the American Community Survey each other, and that little is gained by using both migration stream measures in model estimation. We have opted in this chapter to use the absolute measure, viz., M_{ij}, the migration flow between state *i* and state *j*, as our measure of the migration stream.

Our selected measure of interstate migration, M_{ij}, is the absolute number of Mexicans in each migration stream moving between state *i* and state *j* in the previous year during the 2011–2015 period. Table 17.1 presents data for the ten largest of the 2352 interstate migration streams of Mexicans in the U.S. The largest stream is from California to Texas with an estimated number of 15,274 Mexican migrants. Remarkably, the origin state of the next two largest migration streams is also California. Moreover, of the ten largest migration streams of Mexicans, California is the origin state of three of the streams, and the destination state of four of the streams. The other state figuring prominently in the ten largest streams is Texas; it is the destination state of two of the streams and the origin state of two other streams.

Regarding the smallest migration streams, over 1000 of them have zero Mexican migrants. Specifically, 1035 of the interstate migration streams have no Mexican migrants. Following the practice of researchers analyzing interstate migration streams (Karp and Kelly 1971; Poston and Mao 1996), we have dropped the zero migration streams from our analysis. Included among these 1035 zero-migrant streams are Wyoming-to-Virginia, Mississippi-to-Utah, Wyoming-to-Michigan, Ohio-to-South Dakota, and so forth. Many of these origin and destination states have small Mexican populations, and, moreover, they are frequently a long distance away from each other. Rather than listing each of these 1035 zero-migrant Mexican streams, we summarize them by showing in Table 17.2 each of the forty-nine contiguous states according to the number of zero-migrant Mexican streams in each state at origin and at destination.

The top line of Table 17.2 indicates that Maine had 38 zero-migrant Mexican streams at origin, and 37 at destination. This means that of the 48 possible migration streams departing from Maine to the other 48 contiguous states, 38 of them had no Mexican migrants; conversely, of the 48 migration streams entering Maine from other states, 37 had no Mexican migrants. Three states had more than 40 zero-migrant

Table 17.1 Ten largest Mexican interstate migration streams in the U.S., 2011–2015

Origin State (i)	Destination state (j)	Estimated number of Mexican migrants
California	Texas	15,274
California	Arizona	13,703
California	Nevada	10,783
Arizona	California	8835
Texas	California	8244
California	Washington	7216
New Mexico	Texas	6663
Nevada	California	6533
Texas	New Mexico	5996
Washington	California	5671

Table 17.2 Number of zero-migrant migration streams at origin and destination

State	Number of zero-migrant Mexican streams	
	Origin	Destination
Maine	38	37
New Hampshire	40	39
Vermont	43	40
Massachusetts	19	25
Rhode Island	34	39
Connecticut	27	30
New York	9	16
New Jersey	21	23
Pennsylvania	17	22
Ohio	17	19
Indiana	16	18
Illionois	4	9
Michigan	17	17
Wisconsin	24	25
Minnesota	23	19
Iowa	24	19
Missouri	16	19
North Dakota	34	27
South Dakota	34	32
Nebraska	22	25
Kansas	21	20
Delaware	42	35
Maryland	21	19
D.C.	27	31
Virginia	10	9
West Virginia	34	38
North Carolina	13	7
South Carolina	21	18
Georgia	13	13
Florida	5	5
Kentucky	22	20
Tennessee	19	19
Alabama	25	23
Mississippi	28	25
Arkansas	26	22
Louisiana	25	23
Oklahoma	21	16
Texas	0	2
Montana	35	32
Idaho	25	32
Wyoming	27	28

(continued)

Table 17.2 (continued)

State	Number of zero-migrant Mexican streams	
	Origin	Destination
Colorado	15	7
New Mexico	13	21
Arizona	4	5
Utah	24	20
Nevada	15	15
Washington	5	6
Oregon	20	24
California	0	0
Total	1035	1, 035

Mexican streams at origin: Vermont with 43, Delaware with 42, and New Hampshire with 40. Only one state, Vermont, had 40 zero-migrant Mexican streams at destination. Texas and California had no zero-migrant Mexican streams at origin, and only California had no zero-migrant Mexican streams at destination.

17.3 A Gravity Model and an Ecological Model of Migration

In this chapter we set forth a human ecological explanation of the interstate migration streams of Mexicans in the U.S. in the 2011–2015 period. However, as noted earlier, much of the prior work analyzing migration streams has used gravity models. Thus, we first discuss the gravity model, and then the ecological model.

The gravity model was one of the earliest approaches used to analyze migration streams. It was first proposed by Ravenstein (1885) who emphasized the importance of distance and population size at both origin and destination. He stated that large populations promoted migration, and long distances between the origins and destinations impeded and prevented migration. The gravity model follows this formula:

$$M_{ij} = \frac{P_i P_j}{D_{ij}}$$

where:

M_{ij} represents the number of migrants between states i and j, P_i represents the population size of state i, P_j is the population size of state j, and D_{ij} is the distance between the two states.

The earliest application of this model was Ravenstein's work in two publications over 130 years ago (1885, 1889) in which he noted that "the great body of migrants only proceeds a short distance," and that in estimating migration flows we "must take into account the number of natives of each county which furnishes the migrants, as also the population of the towns or districts which absorb them" (Ravenstein 1885: 12). In a later analysis, Zipf (1946) found that gross migration between two places varies positively with the product of their sizes, and negatively with the distance separating the two places.

Elaborations of the gravity model, especially, the spatial interaction model and the human ecological model, endeavor to identify the specific features or characteristics of the origin and destination populations, other than the actual size of their populations, that promote or impede migration. In most prior research of migration streams, these characteristics have been mainly economic, and the model has been known as the spatial interaction model (Fafchamps and Shilpi 2011; Sen and Smith 1995). Spatial interaction models have been used to analyze migration streams in both developed and developing countries, including the United States (Blanco 1963; Greenwood and Sweetland 1972; Greenwood 1975), Sweden (Isbell 1944), India (Greenwood 1971), the United Kingdom (Flowerdew and Salt 1979; Fotheringham and O'Kelly 1989), Egypt (Greenwood 1969), Japan (Nakaya 2001), and Spain (LeSage and Llano 2013) among several other countries.

The human ecological model we propose and test in this chapter goes beyond the strictly economic considerations of the spatial interaction model. A major difference between ecological and economic models is that ecological models include within their purview the entirety of collective life. An economic model, for instance, does not "investigate the nonpecuniary aspects of economic relationships. Nor does it treat those subsidiary but contingent relationships which do not find expression in a pricing system, such as occur in the family and between nonprofit institutions" (Hawley 1950: 73). Or as Gibbs and Martin (1959: 34) noted 60 years ago, "whereas economists are ordinarily interested in the interrelationships of such variables as supply, demand, cost, and prices within a given sustenance organization, ecologists are concerned with the characteristics of the structure itself" (also see Poston and Frisbie 2019).

We focus now in more detail on the human ecological approach to migration. From the perspective of sociological human ecology, migration is the major mechanism of social change and adaptability for human populations. A knowledge of migration patterns tells us how "populations … maintain themselves in particular areas" (Hawley 1950: 149). The ecological approach asserts that human populations redistribute themselves so to approach an equilibrium between their overall size and the life chances available to them. Migration is seen as the principal mechanism for effecting this adjustment. It is a demographic response attempting to preserve or attain the best possible living standard by reestablishing a balance between population size and organization (Poston 2015; Poston and Frisbie 2019).

The theoretical foundation of sociological human ecology is based on the interdependence of the four conceptual rubrics of population, organization, environment, and technology, sometimes referred to as the POET complex (Duncan 1959). The interrelationships among and between these dimensions inform our understanding of migration patterns. All populations adapt to their environments, and these adaptations vary among the populations on the basis of their social and sustenance organization, their technology, and the size, composition, and distribution of their population. The environment is comprised of both social and physical factors which tend to set constraints on the population and the form and characteristics of its organization. The technology that the population has at its disposal sets in an important way the boundaries for the form and type of environmental adaptation the population may assume. These are often modified when new and/or different technologies are introduced, allowing its relationship with the environment to change, and resulting in changes or adjustments in the population's organization, and in its population size. Human ecology posits that, of the three demographic processes, migration is by far the most efficient agent for returning the human ecosystem to a state of equilibrium or balance between its size and organization (Poston 2015; Poston and Frisbie 2019). We turn now to the variables we use in our models and the hypotheses to be tested.

17.4 Data and Methods

Drawing on human ecological theory as well as prior studies using gravity models in interregional migration studies, the following variables will be used in our explanatory models.

The dependent variable is the total volume of migration of Mexicans between every pair of contiguous states in the U.S. We noted earlier that this variable is the estimated number of Mexican who 1 year earlier, during the 2011–2015 period, were interstate migrants.

With respect to the independent variables, the three variables of population size at origin and at destination, and distance between origin and destination are used in the estimation of a gravity model.

The ecological model consists of variables representing each of the ecological rubrics other than population. Of all the rubrics, it is not an overstatement to note that organization is very important. We have selected the minimum wage as an independent variable to represent the sustenance organization of the population. Although this variable is patently economic in character, it is used here to represent an aspect of the organizational capabilities of the populations.

In sociological human ecology, the environment is defined as "whatever is external to and potentially or actually influential on the phenomenon under investigation" (Hawley 1968: 330). According to this definition, the environment includes not only the biotic or physical characteristics of an area, but, importantly, the "influences that emanate from other organized populations in the same and in other areas; (indeed, the latter may well) acquire a more critical importance than the former" (Hawley 1981: 9). Hispanic concentration, the crime rate, a measure of punitive internal control, and whether the state at origin is contiguous to the state at destination, are selected as independent variables to represent the social aspects of the environment.

Technology has been argued by some scholars as very critical for the adaptation of human populations. It has been defined by Lenski (1970: 37) as "the information, techniques, and tools by means of which men utilize the material resources of their environment." A problem with applying these dimensions to national sub-areas such as states is that, like the larger concept of technology of which they are a part, they have been conceived at the societal level of analysis. So one could argue that it is difficult to contend that the level of technology varies in any significant way at the sub-societal level. One way of getting beyond this quagmire is to focus on the information component of technology and to choose as an independent variable the educational level of the population, a variable that does indeed vary among sub-societal units. This is at best an imperfect solution.

The state level variables, therefore, are population size, distance, contiguity, Latino concentration, crime rate, education level, minimum wage, and internal, i.e., punitive control (Poston and Mao 1996) (Leerkes et al. 2012).

Population size is measured by the total number of people residing in a state in 2010. Distance between two states is measured as the straight line in miles between any two centroids of the states. Minority concentration is measured by the proportion of Latinos residing in the state in 2010. The crime rate is measured as the number of serious crimes known to police per 100,000 population in 2010. The educational level is measured by the proportion of the population with 12 or more years of education who are 25 years of age and older in 2010. The wages variable is measured by the minimum wage in the state in 2010. Lastly, we use data on "internal control" developed in a measure by Leerkes and associates (2012). We will discuss this measure in more detail.

For the years of 2002–2009, Leerkes and colleagues gathered data on "policies targeting unauthorized immigrants" (Ellis et al. 2016: 895). Their indicators of internal control included employer participation, restrictive laws, and county or city involvement. They created levels of restrictive classes which may be reduced to punitive and non-punitive. On the basis of their data, each of the states of the U.S. may be characterized as punitive or non-punitive. The punitive states are Arizona, Arkansas, Colorado, Connecticut, Florida, Georgia, Maryland, Mississippi, Montana, North Carolina, Nevada, Oklahoma, Oregon, South Carolina, Tennessee, Texas, Utah and Virginia (Leerkes et al. 2012). All the other states are coded as non-punitive. We created a dummy variable as 1 = punitive state and 0 = non-punitive state.

All of the above independent variables have been shown to be important and significant predictors of migration in the studies of interprovincial migration cited previously.

Our hypotheses are the following:

1. The larger the population size at both origin *i* and destination *j*, the larger the Mexican migration stream from state *i*, and the larger the Mexican migration stream to state *j*.
2. The shorter the distance between state *i* and state *j*, the larger the Mexican migration stream from state *i* to state *j*.
3. The higher the minimum wage at state *i*, the smaller the Mexican migration flow from state *i*; the higher the minimum wage at state *j*, the larger the Mexican migration flow to state *j*.

4. The higher the concentration of Hispanics at state *i*, the larger the Mexican migration stream from state *i*; the higher the concentration of Hispanics at state *j*, the larger the migration flow of Mexicans to state *j*.
5. The higher the crime rate at state *i*, the larger the Mexican migration flow from state *i*; the higher the crime rate at state *j*, the smaller the Mexican migration flow to state *j*.
6. If state *i* and state *j* are contiguous, the Mexican migration stream between them will be larger than if they are not contiguous.
7. The higher the level of education at state *i*, the smaller the Mexican migration flow from state *i*; the higher the level of education at state *j*, the larger the Mexican migration flow to state *j*.
8. If state *i* is a punitive state, there will be a large Mexican migration flow from state *i;* if state *j* is a punitive state, there will be a small Mexican migration flow to state *j.*

Table 17.3 presents descriptive statistics for all the variables, expressed in their raw versions. When we use these variables later to test the hypotheses, they will all be transformed with natural logarithms. In Table 17.3, the averages and standard deviations for the predictor variables are reported for the variable as measured in the origin state ($State_i$). If all 2352 possible streams were included in the analysis, then the mean and the standard deviation for each predictor variable would be identical for each origin and destination state because its mean and standard deviation in $State_i$ would be calculated for the same 49 states as would be the case for their calculation in $State_j$. But as we noted above, and have shown in Table 17.2, the flows of Mexicans between 1035 pairs of states had no migrants in them, so these flows

Table 17.3 Descriptive statistics of the variables

Descriptive statistics of dependent and independent variables: 1317 interstate migration streams of Mexicans, U.S.: 2011-2015				
	Mean	Standard deviation	Minimum value	Maximum value
Variable				
Interstate migration stream of Mexicans	336.4	953.8	1	15,274
Under gravity model:				
Population size (i) (millions)	8	7.9	0.5	36.6
Distance (miles)	1,175.50	729.1	27	3241
Under human ecological model:				
Punitive state (i) (yes = 1)	0.386	0.487	0	1
Contiguous (yes = 1)	0.15	0.36	0	1
Latinx concentration (i) (million)	1.49	2.92	9164	1.35E+07
Minimum wage (i) (Dollars)	7.45	0.44	6.15	8.55
Educational Level (i) (Proportion of population of state 25+ with 12+ years of education)	0.86	0.32	0.8	0.91
Crime Rate (i) (crimes pa 100,000)	399.4	172.7	122.1	1,326.80

were excluded from the analysis. But the 1035 origin states deleted from the analysis are not necessarily the same as the 1035 destination states deleted (although, as one may surmise, many of the deleted origin and destination states are the same). Consequently, the means and standard deviations of the origin- and destination-specific independent variables are not identical, but they are very similar. Thus our reporting the values of the means and standard deviations of each independent variable for $State_i$ does not detract in any serious way from our understanding of their descriptions. The only two independent variables for which the above discussion does not apply are the distance variable and the contiguity, since their values in each stream are based on pairs of states.

The dependent variable, the migration flow of Mexicans between 1317 pairs of states, has an average value of 336 persons, with a standard deviation of just over 950. There are three streams with only one Mexican in them, and they are between Missouri and Nebraska, Iowa and Vermont, and Utah and Washington, DC. The stream with the largest number of Mexicans, 15,274, is that between California and Texas. Table 17.3 also presents descriptive information for the independent variables.

17.5 Results

Our research estimates two models to predict the size of the interstate migration streams of Mexicans, a gravity model and an ecological model. Prior research indicates that the relationships may be best calibrated into a linear function by taking the natural logarithms of the variables on both sides of the equation. We have transformed logarithmically all the variables used in the equations, with the exception of the dummy variables. These transformations are undertaken because many of the variables are skewed, and, moreover, the bi-variate relationships are not always linear. The transformations correct these problems of nonlinearity and skewness, hence addressing important assumptions of ordinary least squares regression.

The linear function for the classic gravity model is as follows:

$$\mathrm{M}_{ij} = \left(\mathrm{P}_{\mathrm{i}} * \mathrm{P}_{\mathrm{j}}\right) / \mathrm{D}_{ij}, \text{or using natural logarithms,}$$

$$lnM_{ij} = lnP_{\mathrm{i}} + lnP_{\mathrm{j}} - lnD_{ij},$$

where:

lnM_{ij} is the natural logarithm of the absolute value of the migration flow of Mexicans between $State_i$ and $State_j$;

lnP_i and lnP_j are the natural logarithms of population size in $State_i$ and $State_j$, respectively; and

lnD_{ij} is the natural logarithm of the distance in miles between $State_i$ and $State_j$.

Next, the ecological model of interstate migration is estimated as follows:

$$lnM_{ij} = \text{lnMinW}_\text{i} + \text{lnMinW}_\text{j} + \text{lnHC}_\text{i} + \text{lnHC}_\text{j} + \text{lnCR}_\text{i} + \text{lnCR}_\text{j} + \text{CONT}_{ij} + \text{lnEd}_\text{i} + \text{lnEd}_\text{j} + \text{Pun}_\text{i} + \text{Pun}_\text{j}$$

where:

lnMinW_i and lnMinW_j are the natural logarithms of the minimum wage at State_i and State_j, respectively;

lnHC_i and lnHC_j are the natural logarithms of the proportion of Hispanics at State_i and State_j, respectively;

lnCR_i and lnCR_j are the natural logarithms of the crime rate in State_i and State_j, respectively;

CONT_ij is a dummy variable scored 1 if State_i and State_j are contiguous;

lnEd_i and lnEd_j are the natural logarithms of the education variable for State_i and State_j, respectively; and

Pun_i and Pun_j are dummy variables scored 1 if the state has punitive internal control laws, and 0 if not.

We have already mentioned that the units of analysis are the non-zero 1317 migration streams of Mexicans. We report in our analyses both the unstandardized and standardized regression coefficients (both b and β) to gauge the effects of the independent variables on the size of the migration streams.

The results from the multiple regression analysis estimating a classic gravity equation are shown in the first panel of Table 17.4. As in prior research, the gravity equation contains only three independent variables, namely, the natural logarithms of population size at origin and destination, and the natural logarithm of distance between the origin and destination states.

The classic gravity model works just as hypothesized. Population size at origin (i) and at destination (j) are both positively associated with the volume of the interstate migration stream of Mexicans. The coefficients for population size at origin and at destination are both positive and statistically significant. The larger the size of the state at origin and the larger the size of the state at destination, the larger the size of the migration stream of Mexicans from origin and the larger the size of the stream at destination. The independent variable that measures distance between origin and destination state is also statistically significant; its association with interstate migration is negative, as hypothesized. The shorter the distance between origin and destination, the larger the Mexican migration flow. The gravity model accounts for 22% of the variation in the dependent variable of size of migration stream of Mexicans.

We now consider the human ecological model in which we introduced several ecological variables representing characteristics of the states at origin (i) and at destination (j). Several ecological variables were not statistically significant. The following independent variables have statistically significant effects on the volume of the Mexican migration stream. Latino concentration at origin and at destination are positively associated with the volume of the interstate migration stream of Mexicans. The coefficient for Latino concentration at origin is statistically signifi-

Table 17.4 Multiple regression equations: gravity model, ecological model, and combined model

OLS metric (b) and standardized (β) regression coefficients: 1317 interstate Mexican migration streams, U.S., 2011–2015

	Gravity model			Human ecological model			Combined models		
Independent variables	β	b	sig.	β	b	sig.	β	b	sig.
Gravity variables									
Population size									
Origin	0.39	4.72E-05	.000***				−0.056	−6.76e-06	.348
Destination	0.33	4.03E-05	.000***				−0.084	−1.03e-5	.164
Distance	−0.17	−0.22	.000***				−0.218	−.286	.000***
Ecological variables									
Punitive state									
Origin				0.039	76.78	0.087	0.051	100.56	.000***
Destination				0.096	185.61	.000***	0.107	205.99	.000***
Wage									
Origin				0.059	128.54	.008*	0.101	219.15	.000***
Destination				0.03	65.4	.250	0.069	149.97	.005**
Latino concentration									
Origin				.41	1.342E-4	.000***	0.51	1.662e-4	.000***
Destination				.35	1.131E-4	.000***	0.47	1.538e-4	.000***
Education									
Origin				−.01	−294.4	.73	0.004	120.85	.884
Destination				−.01	−371.74	.65	−.000	−24.70	.976
Crime									
Origin				−.00	−.016	.908	−0.016	−.09	.513
Destination				.00	.036	.809	−0.007	−.04	.760
Contiguous				.24	642.40	.000***	0.15	395.92	.000***
Constant		−100.32			−1114.083			−2626.307	
Adj. R2		0.22			.32			.34	

*** <.001; ** <.01; * < .05

cant, as is the coefficient for Latino concentration at destination. State contiguity is also positively associated with the volume of interstate migrant stream of Mexicans, indicating that if two states are contiguous the number of Mexican interstate migrants will be larger than if the two states are not contiguous. Minimum wage at origin is positively associated with the volume of interstate migrant streams of Mexicans. Also, if the destination state is a punitive state there is a positive association with the volume of interstate migration stream of Mexicans. Intuitively, one would think that if a state was classified as punitive, there would be a smaller, not a larger stream of Mexicans to the state.

Human ecological variables that were not statistically significant were punitive state, educational level and crime rate at origin. Other non-statistically significant variables were minimum wage, educational level, and crime at destination. The human ecological model accounts for 32% of the variation in the dependent variable. The human ecological model more accurately predicts the interstate migration of Mexicans than does the gravity model.

Lastly, we combine the classic gravity model variables and the human ecological model into a single OLS regression equation predicating the magnitude of the interstate migration streams of Mexicans. This combined model accounts for 34% of the variation in the dependent variable.

Latino concentration at the state of origin (i) and at destination (j) are both positively associated with the volume of interstate migration stream of Mexicans. The minimum wage variable at destination and at origin are positively associated with interstate migrant stream of Mexicans. Contiguity of states is positively associated with the volume of interstate migrant stream of Mexicans. Distance between the origin and destination states is negative and statistically significant. The shorter the distance between origin and destination state, the larger the Mexican migration flow. Lastly, origin and destination states that were considered states with moderate-high levels of punitive immigration laws, had a positive association with interstate migrant stream of Mexicans.

17.6 Discussion

In this chapter we examined the interstate migration flows of Mexicans among the 49 contiguous states, including the District of Columbia, for the period of 2011–2015. We modeled the Mexican migration flows with a gravity model of migration and a human ecological model of migration. We showed first that the two states of California and Texas have the largest numbers of Mexican migrants, both in terms of sending migrants and receiving migrants. Also, 44% of the 2352 interstate migration streams had no Mexican migrants for the 2011–2015 period. Thus we restricted our regression analyses to those 1317 migration streams with at least one migrant.

In the regression models, the first equation used independent variables based on the classic gravity model; and the second equation used independent variables to represent an ecological model. The gravity variables are simple and straightforward, i.e., consisting of population size at the origin and destination provinces, and the distance between the origin and destination. The ecological model is grounded in the rich theory of human ecology and thus introduces substantive and theoretical meaning into the "bare bones" gravity model. The ecological variables add considerably to an explanation of the interstate migration flows of Mexicans based only on gravity variables. Also, when ecological variables are introduced in the regression equations, the amount of explained variance increases from 22% in the gravity model to 32% in the ecological model. This indicates that a substantial amount of the variance in the migration streams of Mexicans is explained by the ecological variables, and this is an amount over and above that explained by the gravity variables.

Second, although the three gravity variables performed well, this should not come as a surprise. Recall that our regression equations used gross flows as the dependent variable; hence the gravity models contained the independent variables of population size at both origin and destination on the right-hand side as predictors. In such a situation, high associations of population size with gross migration flows should occur automatically.

So, we ask, what do these associations between population size and the migration flows of Mexicans really mean? How do they advance our understanding of the effects of factors of community well-being on the volume of the migration flow of Mexicans? Other than telling us that the Mexican migration stream will be large (or small) if the populations at the origin and destination states are large (or small), they tell us little more.

This critique, however, may not be leveled against the ecological variables. The anticipated relationships of the ecological variables with migration flows are grounded in a rich body of theory that treats the occurrence of migration as a response to an imbalance in an equilibrium relationship between the population size of an area and its level of living. The relationships between the ecological variables and migration contribute considerably more to our understanding of the effects of community well-being on the magnitude of the Mexican migration flows.

The larger the concentrations of Latinos at origin and destination, the larger the flows of Mexicans from the origin, and the larger the flows of Mexicans to the destination. Also, if the origin state is contiguous to the destination state, the flow of Mexicans will be larger than if the states were not contiguous.

Some of the variables did not work as hypothesized by ecological theory. The crime rate both at origin and at destination had no effect on the size of the migration streams from the origin or to the destination. The minimum wage variable at destination, also, was not statistically significant.

In sum, among the major findings of our analysis is that the interstate migration flows of Mexicans in the United States during the period of 2011–2015 are highly responsive to three gravity variables. Population size at origin and at destination serves to encourage migration, and distance is a major deterrent to migration.

But when it comes to answering the query about whether community well-being has an effect on the interstate migration of Mexicans, it is the human ecological model that is preferred.

For the most part, our results indicate that migration theories conceptualized with a classic gravity model and a more comprehensive ecological model, are appropriate for analyzing and understanding the effects of community well-being on the interstate migration flows in the U.S. of Mexicans. Major factors of well-being that encourage migration both at origin and destination are the proportions of Hispanics at origin and destination, and whether or not the states are classified as punitive. More work needs to be done for the further development of the ecological model and we need to entertain a wider body of possible factors of community well-being.

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Chapter 18
Family Values and Work in the Mississippi Delta: Effects of Marriage and Employment on the Well-being of TANF Participants

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18.1 Introduction

Since 1996, the Personal Responsibility Work Opportunity and Reconciliation Act and its amendments have restructured the U.S. welfare system. Responding to the perceived welfare effects on such behavior as labor force attachment, fertility, and marriage, lawmakers used this legislation in their attempt to reshape the behavior of the nation's poor. As a result, recent welfare reforms reflect political concerns regarding employment and family formation among low-income families.

The 1996 welfare program for cash assistance to the poor, Temporary Assistance for Needy Families (TANF), has four main goals: (1) to provide assistance to needy families; (2) to encourage employment; (3) to decrease out-of-wedlock fertility; and (4) to promote two-parent families. Some TANF rules encourage caseload reduction through improvements in the recipients' economic circumstances. Other rules, like time limits, emphasize caseload reduction by simply limiting the receipt of benefits. Over time, as more recipients reach their lifetime limits to cash assistance, it is important to understand the ways in which the successful exit from welfare is possible. Employment and marriage, according to the language of the 1996 welfare reform policy, are viewed as key to this process. In this chapter, we explore the extent to which marriage and employment have the potential to make recipients ineligible for welfare and to lift former recipients out of poverty.

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Recent work exploring the economic importance of marriage has produced ambiguous findings. Results from studies looking only at the effect of marriage across income groups show economic gains associated with marriage (Lerman 2002a, b; Thomas and Sawhill 2002; Remez 1999). Sigle-Rushton and McLanahan's research (2002) compared the economic effects of marriage and employment among low-income women; they revealed, however, that the marriage effect is smaller than the employment effect. Their research relied on average employment and marriage effects among a sample representative of U.S. cities with 200,000 or more persons. However, marriage and labor markets vary geographically. For this reason, local and regional contexts of welfare recipients may be an important determinant of the relative impact of marriage and employment.

In this chapter, we replicate the research of Sigle-Rushton and McLanahan (2002) within the context of a Mississippi Delta state, Louisiana. We estimate a series of regression models to determine the effects that marriage and employment transitions have on improving the economic well-being of welfare recipients. We then simulate marriage and employment transitions for those who are unmarried or who are not working at the time of the survey. Our research uses a sample of recent welfare recipients in metro and nonmetro parishes comprising three labor market areas in Louisiana. Although Bane and Ellwood (1986) studied the relative effects of marriage and employment within the AFDC context, to our knowledge, since the 1996 welfare reforms, no research has examined specifically the relative effects of marriage and employment among welfare recipients. Our research contributes to both the literature on the relative effects of marriage and employment and to evaluation studies concerning the impact of welfare reforms.

Examining the relative impact of marriage and employment in these models, we conclude that both marriage to an employed spouse and employment itself lead to substantial decreases in TANF eligibility. However, at wage levels that can be realistically expected for current and former recipients or for their potential spouses, marriage and employment impacts on family poverty are much smaller than the effects on TANF eligibility. These findings hold in both rural and urban contexts in the Delta area of Louisiana.

18.2 Review of Literature

18.2.1 Marriage

Theoretically, marriage has the potential to improve the economic well-being of men and women by adding an earner to the household, by freeing up time for women to work more outside the home or to pursue a higher education, or by decreasing the cost of childcare (Becker 1981). Marriage also reduces household consumption costs through economies of scale (Waite 1995; Oppenheimer 2000). Less household spending provides opportunities for savings and investments which, in turn, improve the household's financial well-being. Lerman (2002a, b) argued that marriage can also increase economic well-being through the effects of improved mental and physical health on work productivity. Marriage motivates parents to work, creates a wider kin network, and improves the emotional health of couples, all of which are likely to make a worker more productive and lead to higher wages.

Research findings indicate, however, that some types of people benefit more from marriage than do others. For example, men tend to gain more from marriage than women. Among whites, married men earn more than unmarried men, but married women command a lower wage than unmarried women (Loh 1996; Hill 1979; Korenman and Neumark 1991). Black men and women may also benefit less from marriage than do whites. No evidence of a black male marriage premium exists, and black women have lower marriage rates than white women. Wilson (1987) hypothesized that a lack of marriageable partners, or a small pool of "marriageable males," has contributed to low marriage rates and high birth rates among low-income black women. However, according to Wilson and Neckerman (1986) and Wood (1995), the economic characteristics of white males have not had any effect on white marriage rates.

Wilson (1987) has argued that joblessness, in addition to high mortality rates and high rates of imprisonment among young black males, reduce the number of economically attractive black males. Mare (1991) and Lewis and Oppenheimer (2000) found that marriage tends to occur along lines of economic status and education. Women and men of similar education levels and economic status tend to marry each other more often than they marry those of dissimilar statuses. Viewed in conjunction with evidence of assortative mating, the Wilson marriage pool hypothesis suggests that low-income women will be less likely to marry and that the potential impact of marriage on economic well-being in this population group will be smaller than for women with higher incomes. Lichter et al. (2003) have, in fact, investigated the effect of marriage among economically disadvantaged mothers. They found that these women are less likely to marry than are other women but, contrary to expectations, women from disadvantaged backgrounds experience strong economic benefits from marriage.

In addition to individual characteristics, geographic availability also plays a role in who marries. Both men and women are more likely to marry when their geographic area contains a relatively large number of desirable opposite-sex members (Kiecolt and Fossett 1995; Lichter et al. 1992; Lloyd and South 1996). But for the poor population, the size of the marriageable male pool is only slightly associated with the decline in marriage rates (Wood 1995).

18.2.2 Work

The policy emphasis on promoting employment among welfare recipients and the poor is rooted in two observations. The first is the connection between income and poverty status or welfare eligibility. Since earnings contribute to income and income determines welfare eligibility and poverty status, encouraging employment is likely to improve economic well-being. The second observation is the association between unemployment and long-term welfare reliance. Under AFDC, long-term recipients tended to experience long spells of unemployment (Bane and Ellwood 1986).

Labor market theories link economic well-being to the type or quality of job held by an individual. The research on economic well-being and work has emphasized the importance of hours and wages for determining the true economic benefits of employment (Lichter and Eggebeen 1994; Meyer and Cancian 1998; and Harris 1993). The importance of high-wages and full-time work means that shifting from no employment into low-wage employment does not guarantee a significant improvement in economic well-being.

Individual characteristics and the characteristics of the local labor market influence the probability of employment in high-wage, full-time jobs. In research on the poor, several hypotheses have been particularly influential in explaining unemployment patterns. Wilson's (1987, 1996) spatial mismatch argument posits a discrepancy between the location of available jobs and where the poor unemployed live. In addition to spatial mismatch, a skills mismatch argument suggests that black inner-city residents do not have the skills required for the jobs located near them. These include not only "hard" skills such as computer literacy but also "soft" skills such as interpersonal interaction (Moss and Tilly 1996). Although large family size and low education limit the jobs that welfare recipients can realistically hold, structural barriers such as high unemployment or job concentration also impede recipients from finding work (Iceland 1997; Parrott 1998). For the persistently poor, a weak local labor market context is not readily overcome because they cannot move about as easily as persons with savings or assets. Also, without marketable skills, access to jobs located in labor markets elsewhere is limited. Albrecht et al. (2000) extended the spatial and skills mismatch arguments beyond the inner city by suggesting that industrial change may also produce spatial mismatch in rural areas. In general, rural labor markets have undergone major structural change as their industrial bases have been transformed from agricultural, extractive, and manufacturing industries to service production (Duncan and Sweet 1992; Gringeri 1994; Nelson 1999; Summers et al. 1976). The service sector employment that has emerged in rural areas is dominated by janitorial, fast food, hotel, and the rapidly growing home health care industries (Gorham 1992; Nelson 1999; Nelson and Smith 1999). Rural labor markets in general have higher rates of male unemployment and lower rates of both male and female labor force participation than metropolitan labor markets (Tickamyer 1992), reflecting a greater scarcity of formal job opportunities relative to urban areas. These economic trends will likely make moving from welfare to work more difficult for rural residents (Harris 1996; RUPRI 1999).

As with marriage, selectivity is an issue in who finds work and at what wage. Rangarajan et al. (1998) compared welfare recipients to low-income single mothers and found that welfare recipients get poorer quality jobs than do non-recipients. Sandefur and Cook (1998) reached a similar conclusion in their work on determinants of permanent welfare exit via work. They showed that unmeasured characteristics of recipients potentially influenced the relationship between work and exit.

Observed factors could not explain why short-term recipients who had exited welfare for work were different from long-term recipients. They speculated that some of the unmeasured heterogeneity may result from emotional or physical health differences or disparate local labor market contexts.

18.2.3 Marriage, Employment, & Economic Wellbeing

There are just a few theoretical and empirical studies of the relative effects of employment and marriage on improving the economic well-being of low-income groups. Most work has relied on research and theory regarding the separate effects of marriage and employment (Lerman 2002a, b; Acs and Nelson 2004). Thomas and Sawhill (2002) used shift-share and microsimulation techniques to estimate the effects of marriage, but they did not incorporate any change in earnings or estimate results of becoming employed. Using a nationally representative sample of households, Acs and Nelson (2004) examined the effects of marriage among cohabiting couples, given that their other characteristics remain the same. They did, however, take the male marriage premium into account in one simulation and compared simulated results with and without increases in fathers' average hours of work. The work of Sigle-Rushton and McLanahan (2002) stands out as an exception to studies of employment and marriage effects because they considered the effects of changes in women's marital and employment statuses simultaneously. They simulated what poverty rates and incomes would be if currently unmarried women were to take on family-work roles, i.e., female breadwinner, partner to male breadwinner, or dual-earner, similar to those of married women. They found that full-time employment (working 2000 h per year) has a more dramatic effect than changes in family structure have on reducing poverty and increasing incomes.

In this research we examine marriage and employment transitions to determine which is more economically beneficial for recent Louisiana welfare recipients. Based on past research, marriage, if it leads to the formation of a household with two working adults, is expected to improve the economic position of single-mother families (Lichter et al. 2003). Similarly, employment, if it leads to a job with full-time hours and a wage above the minimum, is expected to successfully raise a family out of poverty and welfare. It is unclear, however, which one of these optimal conditions will be more economically beneficial for welfare recipients. None of the theories addressing benefits solely from employment or from marriage provide precise insight into the relative magnitude of benefits. The research findings from marriage, employment, and poverty studies, however, lead us to believe that given assortative mating, employment will be more economically beneficial for current and former welfare recipients. In addition, we expect that recipients in locations with more high-wage employment opportunities, such as New Orleans, will be more likely to experience the benefits from employment than would recipients in the Mississippi Delta region where high-wage opportunities are scarce.

18.3 Data and Methods

18.3.1 Data

The Louisiana Welfare Survey is based on a stratified random sample of 1998–1999 TANF recipients of cash assistance in three welfare districts in the city of New Orleans–Algiers, Gentilly, and Midtown, and in twelve parishes in the northeast Delta of Louisiana. The twelve parishes in the Delta region form two contiguous labor market areas: one is centered on Monroe, and the other is a non-metropolitan labor market, i.e., one without a metropolitan core. These two labor market areas stretch around Monroe to the Louisiana-Arkansas border to the north, to the Mississippi river to the east, south to Ferriday and Vidalia, and from Sicily Island back to Monroe. When the survey began, the only metropolitan area in the two northeastern Delta labor market areas was Monroe with a population slightly above 50,000. Union Parish has since been designated part of the Monroe metropolitan area but is not considered so in our analysis. The Delta parishes and New Orleans neighborhoods that we include in our analyses have total poverty rates and race-specific poverty rates well above the U.S. poverty rate. Despite having employment growth slightly better than the U.S. national rate of growth between 1989 and 1999, our study parishes still have employment rates lower than the U.S. overall.

Our results are, strictly speaking, generalizable only to those areas of Louisiana from which the sample was drawn. However, these are important areas to understand because they represent persistent pockets of limited economic opportunity located in predominantly black rural communities and inner-city neighborhoods. In addition, results within Louisiana's new welfare system can offer important insights. Under TANF, Louisiana, unlike many other states, allows recipients to continue receiving cash assistance for up to 6 months while working.

The initial survey population consisted of persons 18 years of age or older who, according to administrative records, received cash assistance payments as of March 1998. We augmented the survey population with another sample drawn in February 1999. A comparison of the baseline interviews conducted with the initial sample and the supplement indicates no significant differences in the characteristics of the two samples. Survey interviewing over the 1998–2001 period was done mainly via CATI (Computer Assisted Telephone Interviewing) technology. However, since this population was not easily reached by telephone, we attempted to interview respondents face-to-face when they did not have telephones. Our baseline sample included 992 valid respondents, nearly equally divided among the northeastern Delta parishes and the New Orleans districts. As is the case with the Louisiana FITAP caseload, all but a few (18) respondents were women.

Examining the descriptive characteristics (Table 18.1) of our respondents in 2000 reveals that they resemble FITAP participants across Louisiana (based on FITAP evaluation by Berkeley Policy Associates, Valvano and Abe 2002). A sizeable minority of respondents reports having less than a high school education, though 60% have a high school education or higher. The overwhelming majority are

Table 18.1 Descriptive Characteristics of Sample

	Single			Married			Non-employed			Employed		
Tanf eligibility & poverty	*N*	*Mean*	*Std. dev.*	*N*	*Mean*	*Std. dev.*	*N*	*Mean*	*Std. dev.*	*N*	*Mean*	*Std. dev.*
Not poor	437	0.08	0.279	36	0.19	0.401 **	273	0.02	0.147	200	019	0393 ***
Not TANF eligible	521	0.36	0.480	50	0.46	0.503	302	0.16	0.363	269	0.61	0.490 ***
FITAP eligible	530	0.53	0.499	52	0.38	0.491 **	309	0.71	0.454	273	0.30	0.461 ***
KCSP eligible	520	0.13	0.337	50	0.16	0.370	302	0.16	0.366	263	010	0306 ***
Marriage												
Becomes married	530	0.00	0.000	52	0.46	0.503 (a)	309	0.04	0.194	273	0.04	0.205
Stays married (not married in 2000)	530	0.00	0.000	52	0.54	0.503 (a)	309	0.05	0.222	273	0.04	0.205
Spouse's employment in 2000												
Spouse works	530	0.00	0.000	52	0.37	0.486 (a)	309	0.03	0.159	273	0.04	0.197
Spouse earrings	530	0.00	0.000	52	125.21	483.003 (a)	309	13.90	181.063	273	8.11	96.598
Employment												
Becomes employed	530	0.23	0.421	52	0.17	0.382	309	0.00	0.000	273	0.48	0.501 (b)
Stays employed (not employed in 2000)	530	0.24	0.425	52	0.29	0.457	309	0.00	0.000	273	0.51	0.501 (b)
Hourly wage	492	293	4.493	47	2.65	3.571	309	0.00	0.000	230	6.80	4.386 (b)
Above minimum wage ($5.15)	492	0.37	0.482	47	0.34	0.479	309	0.00	0.000	230	0.85	0.356 (b)
Ful-time (40 h/week or more)	520	0.20	0.402	51	0.16	0.367	309	0.00	0.000	262	0.43	0.496 (b)
Worked last month	530	0.03	0.181	52	0.00	0.000	309	0.00	0.000	273	0.07	0249 (b)
Location												
Delta metro	516	0.16	0.371	50	0.18	0.388	302	0.18	0.384	264	0.15	0359
Delta Normetro (New Orleans)	516	0.33	0.471	50	0.50	0.505**	302	0.37	0.485-	264	0.31	0.465
Controls												
Less than Hgh school	529	0.41	0.492	52	0.46	0.503	308	0.48	0.501	273	0.33	0.472 ***
Age in 1999	522	33.70	11.734	51	34.41	14.059	303	35.33	12.728	270	32.01	10.759 ***
Years on AFDC/TANF	487	7.00	5.783	50	7.80	7.091	280	7.59	5.909	257	6.51	5.878 **

(continued)

Table 18.1 (continued)

	Single			Married			Non-employed			Employed		
Tanf eligibility & poverty	*N*	*Mean*	*Std. dev.*	*N*	*Mean*	*Std. dev.*	*N*	*Mean*	*Std. dev.*	*N*	*Mean*	*Std. dev.*
Not white	526	1.31	6.045	52	0.81	0.398	307	1.57	7.906	271	0.92	0.268
Number of own children in HH	530	251	1.740	52	2.40	1.600	309	2.41	1.852	273	2.60	1.571
Number of jobs held since 16	490	4.53	5.009	49	5.14	4.257	289	4.44	5.335	250	4.75	4.456
Baseline sample	530	0.37	0.484	52	0.35	0.480	309	0.38	0.485	273	0.36	0.482

unmarried, female, and non-white, and 47% reported being currently employed. Median monthly family income is only $208 which reflects the large number of people who reported having no or very little family income. Our analyses use only the 1998–99 and 2000 waves with the 582 respondents from 2000 being the effective sample and the 1998–99 wave providing only information on employment, marital status, TANF eligibility, and poverty status.

18.3.2 Estimation Methods

In order to determine the effect employment and marriage have on improving the economic well-being of the welfare recipients in our survey, we estimate a series of regressions on the log-odds of becoming ineligible for TANF and on the log-odds of exiting poverty. Because we observe relatively few marital and employment transitions between 1998/9 and 2000, our sample provides limited statistical power, particularly in analyzing the effects of marital transitions. To better estimate the relative effects of marriage and employment, in addition to our logistic regression models, we simulate marriages among the unmarried and employment among the non-employed, incorporate predicted earnings for the respondent or spouse, and then examine the effect on the proportion of our sample in poverty and the proportion eligible for TANF.

18.3.3 Dependent Variables

The main goal of welfare reform since 1996 has been to reduce the welfare caseload. The main criticism of this goal is that it does not guarantee a reduction of poverty rates. In this study we examine the effect transitions into both marriage and employment, from one wave (1998 and 1999) to another (2000), have on reducing the caseload and the number of people in poverty. Our first dependent variable is TANF ineligibility in 2000. Louisiana's TANF program has three major components: the Family Independent Temporary Assistance Program (FITAP), the Kinship Care Subsidy Program (KCSP), and the Family Independence Work Program (FIND Work). The FIND Work (the Family Independence Work Program) acts as the work component of TANF. In this paper we focus on FITAP and KCSP as they are the cash assistance programs. We use official Louisiana FITAP and KCSP program guidelines to determine an individual's eligibility for either of the two. We consider individuals ineligible for TANF if they are ineligible for both FITAP and KCSP. We consider individuals eligible for TANF if they are eligible for either of these two sub-programs.

Eligibility for FITAP assistance is based on four criteria. First, the applicant must be a member of a qualifying family type. There must be a child living with a relative, related by at most the fifth degree, e.g., great-great-great grandparents or children of first cousins, or through adoption, to be considered a qualifying family. Second, countable income must be less than the need standard threshold, which is based on family size. Third, countable resources added to the countable income must be less than the need standard threshold for a family of a given size. Resources and income that are not counted include a vehicle, countable resources that are equivalent to less than $2000, funds in an Individual Development Account (IDA), property for sale, lump sum Earned Income Tax Credits, and inaccessible resources. Fourth, the applicant may not have been previously disqualified from receipt due to sanctions or failure to meet other basic eligibility requirements, e.g., citizenship, residence, or parental relationship.

To be eligible for Kinship Care Subsidy, a non-foster child must be in the legal custody of a non-parental related adult, related by at most the fifth degree, and, moreover, the parent must not live in the household. In order to be financially eligible to file for receipt of the subsidy, a caretaker's family income must be lower than 150% of the poverty threshold corresponding to his or her family size. The size of the family includes the caretaker relative, plus all children for whom he or she is responsible. The subsidy, however, does not include the adult caretaker in the family size and reflects only the number of related children for whom the adult wishes to file. Each eligible child receives $222 a month.

Our second dependent variable is not being poor in 2000. To construct this variable, we used the official Census Bureau poverty threshold values for 2000. A household is considered poor if the combined adult income falls below or is equal to the threshold value that corresponds to its family size and composition. Family size includes all related adults and all children, except foster children. Income includes all cash benefits, including cash subsidies, excluding housing and food stamp vouchers.

Using TANF ineligibility as a dependent variable allows us to state directly how many current recipients would no longer be on the rolls due to a marriage or employment transition. Using welfare exit as the dependent variable would capture people who voluntarily or involuntarily exit TANF even if their income is below the need standard. We use ineligibility based on income and family size as the dependent variable that captures moves off welfare accomplished through increased income.

18.3.4 Independent Variables

18.3.4.1 Employment and Marital Transitions

Across the waves of the survey, a respondent is classified as having gone through an employment transition or marital transition if the reported employment or marital status is different in 2000 than it was in 1998 or 1999. In our sample few marriages occur over the time period considered, making it likely that our regressions underestimate the effects of marriage based on this transition.

18.3.4.2 Characteristics of the Spouse

Marriage has the potential to be economically beneficial if one marries a spouse capable of contributing to a family's income (Lerman 2002a, b; Becker 1981; Sigle-Rushton and McLanahan 2002). For this reason, we include earnings of a respondent's spouse in some of the regression models. However, the estimates of spouse's earnings may be upwardly biased and correlated with the probability of marrying. We estimate spouses' monthly earnings as a residual, that is, subtracting the respondent's earnings and other reported income from the estimated total family income for the year, divided by twelve. This method likely overestimates spousal earnings and makes it more likely that we find significant effects in the regression models.

18.3.4.3 Characteristics of Work

In addition to more pay, jobs with more hours also tend to have fringe benefits such as eligibility for sick days, vacation time, and health benefits. We include measures of hourly wage (a dummy variable for earning above minimum wage) and number of hours worked per week (a dummy variable for working 40-hours a week) as indicators of job quality in the logistic regression models.

18.3.4.4 Location

Available jobs in rural areas are often less attractive and offer wages less likely to lead to economic self-sufficiency than those in urban areas. Low wages, part-time hours, and lack of benefits such as sick-leave and health insurance, and low returns to human capital investments often combine to make "employment hardship" a characteristic of the formal rural economy (Gorham 1992; Lichter 1989; Findeis and Jensen 1998; RUPRI 1999). We assess spatial heterogeneity across three locations in Louisiana by including dummy variables indicating if a respondent lives in Monroe, the rural Delta, or in New Orleans (the reference category).

18.3.4.5 Controls

We include controls for human capital, specifically, education, labor market experience, and duration of AFDC spell. Labor market experience proved to be insignificant and was dropped from the models presented in Tables 18.4a and 18.4b. Generally, research has found that exiting welfare through work is most likely for those recipients who have more human capital (Sandefur and Cook 1998; Lichter 1989; Meyer and Cancian 1998; Harris 1993). We use education, i.e., high school education or more vs. no high school education, as a measure of human capital endowment. In addition, we test for effects of measures associated with the acquisition of human capital–labor market attachment and duration of AFDC/TANF spell. A longer AFDC/

TANF spell indicates time not spent in the formal labor market or time spent employed at a very low wage. Having worked in the past indicates job experience. According to research by Bernhardt et al. (2001), the positive effect of job experience or acquisition of marketable experience may be counteracted by job instability, or by having a large number of past jobs. However, for persons on public assistance and others with low educational attainment, job instability might be more a characteristic of the job than a characteristic of the individual. Changing jobs frequently might not indicate an inability to hold a job long term, but it might reflect the fact that many jobs in the secondary labor market are temporary. Other variables, namely, age, race, number of children, and lagged dependent variable, control for population heterogeneity. Age and race are known to affect the likelihood of marriage and employment prospects. The number of children directly affects poverty status and may limit viable job prospects. By including a lagged dependent variable, we effectively control for unobserved factors that influence TANF eligibility and poverty status.

18.4 Results

We will first consider the characteristics of respondents by marital status and employment status (Table 18.1). Any substantial difference in earnings/income across these groups will show the effects of the benefits of employment and marriage. In our sample of 582 women in 2000, only 52 are married. Among the married women, 46% are employed, and only 37% have working spouses. There is no significant difference in the proportion employed among single women and married women. However, a significantly higher percentage of married women are not poor and are ineligible for TANF. Similarly, a greater percentage of employed women is not poor and ineligible for TANF. Both marriage and employment seemingly confer some economic benefit.

Without comparing the well-being of employed single women to that of employed married women and similarly of non-employed singles to non-employed marrieds, we cannot ascertain the effects of employment net of marriage and that of marriage net of employment. Unfortunately, the small number of married respondents in our sample precludes meaningful tabulation across marriage and employment states. However, our regression analyses can provide us with some insight. Before turning to those regression results, we will inspect the sample means for signs of selectivity in marriage and employment. As employment and marriage are both states into which individuals self-select, we expect differences in individual characteristics. We find no marked differences between married and single respondents with respect to age or education, but a greater proportion of married women reside in Louisiana's rural Delta parishes. Across employment states, more employed respondents tend to have completed at least a high school education (67% versus 52%), and their income, including cash assistance, also tends to be higher than that of unemployed respondents ($650 versus $208). Non-employed respondents have spent significantly more years on the welfare rolls than the employed have (7.6 years versus 6.5), on average.

To capture the effects of marriage and employment, one net of the other, we model effects of women's marital and employment transitions on TANF eligibility and poverty status in 2000 (see Tables 18.2 and 18.3). Our findings suggest that although both marriage and employment transitions contribute to declines in the welfare caseload, employment transitions have a stronger impact on reducing family poverty. In the rest of this section, we will first discuss findings from our logistic regression models and then review the results from simulations of marital and employment transitions.

18.4.1 Logistic Regression Models

Our first set of logistic regressions examines the effect of marital and employment transitions on TANF ineligibility (Table 18.2). We find that at the .10 level, marriage significantly increases the odds of being ineligible for TANF cash assistance. Because there are so few marital transitions observed among our respondents from 1998–2000, this is a stronger finding than it might be in a larger, less homogenous sample. For us to observe any effect of marital transitions speaks to the strength of the relationship between ineligibility and marital status.

We include spousal earnings in a later model in order to capture effects of the mechanism through which we expect marriage to influence eligibility. For singles, spousal earnings equal zero. We find no significant effect of spousal earnings, but the transition to marriage remains significant at the .10 level. This result is expected as our sample contains information on only a few spouses. Moreover, the inclusion of both marital transitions and spousal earnings likely attenuates the observed effects of marital transitions.

Becoming employed reduces the odds of being eligible for TANF (Table 18.2). Even after incorporating variables to account for job quality and wages through which employment produces ineligibility for TANF, the transition from not working to being employed still has a significant effect at the .05 level. Although incorporating employment and marital transitions in the same model reduces the significance level of the employment transition itself (possibly due to endogeneity with respect to employment and marital transitions), the effects of hours of work and wage are still significant and strong. Working for more than minimum wage increases the odds of TANF ineligibility, as does working 40 or more hours.

Turning to the effect of marital and employment transitions on poverty status (Table 18.3), the results of our logistic regression models show significant and persistent effects of employment transitions on the odds of not being poor. The findings that are consistent with studies of income and family type include the following: (1) the strong effect of full-time work in reducing family poverty, even after controlling for spousal earnings; (2) the effect of smaller family size—more children decrease the odds of not being poor (odds ratio for number of children is significantly less than one in all models, not shown in the tables).

Table 18.2 Effects of Marriage and Employment of TANF Ineligibility in 2000, Maximum Likelihood Logit Estimates of Odds Ratios

	Marriage transition		Marriage		Employment transition		Employment		Employment & marriage	
	Odds	s.e	Odds	s.e	Odds	s.e	Odds	s.e	Odds	s.e
Not TANF eligible in wave 1 (1998)	203	0.46 ***	203	0.459 ***	1.641	0.54	1.39	0.49	1.36	0.49
Marriage transitions:										
Unmarried to marred	230	1.14*	230	1.14*					1.94	1.42
Stayed married	1.46	0.72	1.47	0.763					2.36	1.74
Ref.: Not married in 2000										
Characteristics of spouse:										
Monthly earnings			1.00	0.001					1.00	0.00
Employment transitions:										
Unemployed to employed					15.44	5.61 ***	3.17	1.56 **	3.23	1.60**
Stayed employed					12.28	4.53 ***	2.66	1.28**	2.67	1.30**
Ref.: Not employed in 2000										
Characteristics of work:										
Wage above minimum							5.66	2.43 **	5.57	2.40 ***
Working 40 h/week or more							7.34	3.11 ***	7.74	3.32***
Woked <1 month at current job							0.35	0.26	0.36	0.26
Location:										
Monroe	0.97	0.29	0.97	0.286	1.104	0.42	0.85	0.35	0.86	0.36
Rural Delta	0.84	0.20	0.84	0.199	0.864	0.27	0.85	0.29	0.79	0.27
Ref.: New Orleans										
N		491		491		426		426		426
LR chi2		59.730 ***		59.730 ***		171.7 ***		218.2***		−155.68***
Df		11		12		11		14		17
LL		−292.8		−292.8		−180.2		−156.9		220.7
Psuedo R2		0.0926		0.0926		0.323		0.41		041

Note: Reference Group is white, unmarried, high school graduate, living in New Orleans, not TANF eligible in 1998–99
*p < .10; **p < 0.05; ***p < .01 All models control for education, age, years on AFDC/TANF, race, number of children, and survey design effects

Table 18.3 Effects of marriage and employment on not poor in 2000, maximum likelihood logit estimates of odds ratios

	Marriage transition		Marriage		Employment transition		Employment		Employment & marriage	
	Odds	s.e	Odds	s.e	Odds	s.e	Odds	s.e	Odds	s.e
Not in poverty in wave 1 (1998)	2.64	1.646	233	1.494	219	1.545	243	1.866	1.38	1.142
Marriage transitions:										
Unmarried to married	1.41	1.209	1.39	1.192					1.98	1.909
Stayed married	1.89	1.687	0.77	0.944					1.60	2.049
Ref: Not married in 2000										
Characteristics of spouse:										
Monthly earnings			1.00	0.002					1.00	0.002
Employment transitions:										
Unemployed to employed					23.20	16.239 ***	5.54	5.128 *	6.47	6.174 **
Stayed employed					14.93	11.426 ***	3.77	3.669	4.34	4.359
Ref: Not employed in 2000										
Characteristics of work:										
Wage above minimum							3.20	2.082 *	287	1.909
Working 40 h/week							4.11	2.118 ***	5.23	2.855 ***
Worked <1 month at current job							0.32	0.361	0.32	0.378

(continued)

	Marriage transition		Marriage		Employment transition		Employment		Employment & marriage	
	Odds	s.e	Odds	s.e	Odds	s.e	Odds	s.e	Odds	s.e
Location:										
Monroe	0.34	0.240	0.36	0.260	0.39	0.288	0.41	0.315	0.45	0.354
Rural Delta	0.71	0.340	0.80	0.385	0.94	0.461	0.97	0.520	0.98	0.559
Ref: New Orleans										
N		357		357		357		357		357
Lr chi2(11)		28.790 ***		31.560 ***		60.570 ***		75.770 ***		81.710 ***
Df		11		12		11		14		17
LL		−90.975		−89.591		−75.085		−67.485		−65.514
Psuedo R2		0.137		0.150		0.287		0.360		0.388

Reference Group is white, unmarried, high school graduate, living in New Orleans, not in poverty in 1998–99. *$p < .10$; **$p < 0.05$; ***$p < .01$
All models control for education, age years on AFDC/TANF, race, number of children, and survey design effects

18.4.2 Simulations

Based on our logistic regression models, we may conclude that employment has a stronger effect on a reduction of TANF caseloads and poverty than does marriage. However, given the relatively short time interval of just over 1 year for most respondents between our data waves, we hesitate to use these models alone to draw our conclusions. We hence ask, what would be the effect of marriage relative to employment if we could observe more transitions into marriage? We will compare simulations of marital transitions from unmarried to married and from not working to employed in order to answer this question. Because married women may differ significantly from unmarried women, we show simulation results separately for those two groups.

We simulate marital and employment transitions under three separate scenarios. First, we assume that all newly employed persons will earn the gender-specific median level of earnings among earners in their parish. Second, we assume that all employed persons will earn \$6 per hour and work full-time. This assumption is based on the fact that \$5.50 to \$6.00 dollars per hour is the average pay offered for vacant jobs for which the overwhelming majority of current and former recipients in our sample qualifies. Finally, we assume that the newly employed will earn the amount predicted. We use Heckman selectivity models in our analyses. The Heckman models predict positive wage/monthly earnings below minimum wage in a few cases; we set these to the minimum wage (\$5.15 at the time of the analysis).

Our simulations (Tables 18.4a and 18.4b) show that employment of married women at median wages reduces the proportion of the sample in poverty by over one third (82% to 49%) and the proportion eligible for TANF by over three quarters (56% to 15%). The employment of unemployed spouses at median earnings levels has a similar, although weaker, effect. The employment of unmarried women at median wages, however, has an even stronger effect, potentially reducing the proportion in poverty from 92% to 39% and the proportion eligible for TANF from 64% to 16%. Surprisingly, given our logistic regression findings with respect to spousal earnings, the hypothetical marriage of single women to men with median earnings produces the most dramatic reduction in poverty levels and TANF eligibility–92% to 3% and 64% to 10%, respectively. This finding regarding the relative effects of employment and marriage of single women reflects the gender differential in earnings. Median earnings for working men are consistently higher than median earnings for working women in all parishes. Gender differences in occupations and hours of work likely produce this result, making it more effective for a woman to marry a man earning at or above the male median than to earn the female median wage.

Neither of the first two scenarios discussed above allow for variation in individual characteristics to influence predicted earnings for women or their husbands. Following procedures used in a traditional Heckman selectivity model for hourly wages, we can control for differences in who becomes employed/married and how the characteristics that affect who becomes employed/married may similarly influ-

Table 18.4a "Simulated" poverty status & eligibility, 2000

	Percent					*Ratio actual percent to simulated percent*		
	%Poor	%TANF Eligible	%FITAP Eligible	%KCSP Eligible	Poor	TANF Eligible	FITAP Eligible	KCSP Eligible
SINGLE WOVEN								
Actual	91.8	64.1	53.6	13.0	– –	– –	– –	– –
Unemployed becomes employed								
@median earnings among earners	39.0	15.6	14.4	21	0.42 **	0.24 **	0.27 **	0.16 **
@expected entry wage $6 FT/year round	60.8	17.7	16.0	25	0.66 **	0.28 **	0.30 **	0.16 **
@Heckman estimated wage 30 h/week year round	77.5	23.2	21.3	3.2	0.84 **	0.36 **	0.40 **	0.24 **
@Heckman estimated wage 40 h/week year round	66.4	18.8	17.5	26	0.72 **	0.29 **	0.33 **	0.20 **
Unmarried acquire employed spouse								
@ median earnings among earners	28	10.1	0.0	10.3	0.03 **	0.16 **	0.00 **	0.79
@Heckman estimated monthly earnings	95.3	64.6	57.6	10.3	1.04 *	1.01	1.07	0.79
MARRIED WOMEN								
Actual	81.8	55.6	38.3	17.8	–	–	–	–
Unemployed becomes employed								
@median earnings among earners	48.5	14.9	14.9	0.0	0.59 **	0.27 **	0.39 **	0.00 **
@expected entry wage $6 FT/year round	60.6	17.0	17.0	0.0	0.74 *	0.31 **	0.44 *	0.00 **
@Heckman estimated wage 30 h/week year round	69.0	27.7	25.5	23	0.84	0.50 **	0.67	0.13 **
@Heckman estimated wage 40 h/week year round	65.5	17.0	17.0	0.0	0.80	0.31 **	0.44 *	0.00 *

(continued)

Table 18.4a (continued)

	Percent					Ratio actual percent to simulated percent		
	%Poor	%TANF Eligible	%FITAP Eligible	%KCSP Eligible	Poor	TANF Eligible	FITAP Eligible	KCSP Eligible
Unemployed spouse becomes employed								
@median earnings among earners	59.4	29.8	21.3	8.9	0.73 *	0.54 **	0.56 *	0.50
@expected entry wage $6 FT/year round	81.3	46.8	40.4	8.9	0.99	0.84	1.06	0.50

Note: Median=median earnings for all earners in county in 1999 as reported in U.S. 2000 Census. If Heckman predicted less than $5.15, then set to $5.15. Heckman prediction for spouses is for monthly earnings. With our data, it is not possible to separate spouses' hourly wages and hours of work for the month. Expected Industry/occupation wage of $6 in all parishes based on Louisiana Job Vacancy Survey 1999–2000 and Occupational Survey 2000
**$p < 0.01$, *$p < 0.05$ reject null hypothesis that ratio equals one, i.e. simulated percent equals actual percent, one-tailed test

ence own/spouse's earnings. Pooling information from the survey waves, we apply Heckman models to both respondents' potential earnings and potential earnings of prospective/current husbands.

Generally, results for our final (Heckman) scenarios produce similar reductions in TANF eligibility, but more modest reductions in poverty status than simulations using median earnings. For married women, the proportion poor drops from 82% to 61% if women who are not working become employed at Heckman-predicted wages in a full-time job. If non-working spouses become employed, the reduction in poverty is not significant, dropping from 82% to 81%. For single women, the Heckman full-time simulation shows reduction in poverty similar to simulations using expected entry-level jobs with a $6 hourly wage. In both cases the proportion poor goes from 92% to between 60% and 70%. In the case of single women marrying employed men under the Heckman simulation, TANF participation levels are reduced but are still high, with the proportion eligible for TANF going from 64% to 44%. Poverty levels, in this case, are about the same (92% versus 94%). The Heckman simulation results with respect to poverty for single women marrying employed men are a result of low earnings levels predicted for spouses and the increase in family size that accompanies marriage.

Previous analyses undertaken with these data and regressions estimated for this research seldom show significant effects of labor market area. However, whenever significant effects occur in our results, they show significant differences between the Delta nonmetro area and New Orleans, but not between the Delta metro area and New Orleans. Because theory suggests that geography influences marriage markets and labor markets, we present separate results for the metro and nonmetro labor markets (Table 18.4b). The results are similar to those for the entire sample.

Table 18.4b "Simulated" poverty status & eligibility, 2000

	Deltanonmetro				Metro			
	%poor	%TANF	%FITAP	%KCSP	%poor	TANF	%FITAP	%KCSP
		Eligible	Eligible	Eligible		Eligible	Eligible	Eligible
SINGLE WOVEN								
Actual	93.3	68.8	54.0	16.0	90.9	61.8	53.4	11.5
Unemployed becomes employed								
@median earnings among earners	40.3	15.9	126	24	28.2	15.4	15.3	20
@expected entry wage $6 FT/year round	57.7	17.8	14.9	3.0	625	17.6	16.8	24
@Heckman estimated wage 30 h/week year round	720	24.1	21.2	3.6	80.5	227	21.3	29
@Heckman estimated wage 40 h/week year round	61.6	21.3	19.0	3.0	69.0	17.6	16.8	23
Unmarried acquire employed spouse								
@ median earnings among earners	5.5	10.9	0.0	11.2	14.4	9.7	00	9.8
@Heckman estimated monthly earnings	97.2	66.1	57.5	11.2	94.3	63.9	5.77	9.8
MARRIED WOMEN								
Actual	76.5	47.6	27.3	19.1	87.5	625	48.0	16.6
Unemployed becomes employed								
@median earnings among earners	41.2	0.0	0.0	0.0	56.2 *	28.0 *	28.0 *	0.0
@expected entry wage $6 FT/year round	41.2	4.6	4.6	0.0	81.3 *	28.0 *	28.0 *	0.0
@Heckman estimated wage 30 h/week year round	60.0	13.6	13.6	0.0	78.6	40.0 *	36.0 *	42
@Heckman estimated wage 40 h/week year round	53.3	4.6	4.5	0.0	78.6	28.0 *	28.0 *	0.0
Unemployed spouse becomes employed								
@median earnings among earners	58.8	18.2	13.6	4.8	60.0	40.0 *	28.0	125
@expected entry wage $6 FT/year round	76.5	31.8	27.3	4.8	86.7	60.0 *	52.0 **	125

Note: Median=median earnings for all earners in county in 1999 as reported in U.S. 2000 Census. If Heckman predicted less than $5.15, then set to $5.15. Heckman prediction for spouses is for monthly earnings. With our data, it is not possible to separate spouses' hourly wages and hours of work for the month. Expected Industry/occupation wage of $6 in all parishes based on Louisiana Job Vancancy Survey 1999–2000 and Occupational Survey 2000
**p < 0.01, *p < 0.05 reject null hypothesis that ratio Delta nonmetro estimate equals metro estimate, one-tailed test

Employment simulations produce stronger effects than do marriage simulations for single women in both the urban and rural parishes. Effects of simulations among married women, however, are significantly different in the metro and nonmetro samples. Current spouses becoming employed would produce a greater reduction in the proportion of married women eligible for TANF in nonmetro areas than in metro areas. Thus, marriage has a potentially stronger effect in rural areas.

The above results represent the short-term effects of marriage and employment. They must be interpreted with caution because we cannot account for other changes which might accompany marriage or employment. Becker (1981) has pointed out that marriage often leads to changes in an individual's relationship to employment. The addition of another earner may lead men or women to drop out of the labor force to care for children. Demographic theories also point to the close connection between marriage and fertility. The addition of another child may make families eligible for TANF and/or reduce their labor force participation. Such changes in employment behavior could undermine the long-term economic benefits of marriage.

18.5 Summary and Conclusion

Welfare reform since 1996 has sought to reduce reliance on cash assistance. The guidelines to promote this goal require that welfare participants become employed and no longer penalize pregnant teens for marrying. Unfortunately, it remains unclear if the changes encouraged by these new regulations will reduce poverty among TANF recipients. In Louisiana, for instance, most current and former recipients work in low-wage jobs that last less than a year, thereby limiting the likelihood of moving out of poverty (Valvano and Abe 2002). Also, because people tend to marry people of similar economic background, those in intact families are not guaranteed an escape from poverty. Moreover, economic stress has been shown to increases marriage instability. Lichter and his colleagues (2003) found that economically disadvantaged women are more likely to be worse off after a divorce than they were before the divorce. Even if welfare recipients benefit from marriage and employment in the short-term, it is possible that in the medium- to long-term, they will be worse off.

We empirically addressed concerns that the new emphasis on work and marriage in welfare legislation raises. By comparing the effects of work and marriage in our sample of current and former welfare recipients in three Louisiana labor market areas, we can make judgments about the short-term effects of marriage and employment within the welfare populations in these areas. While our regression results for employment show that net of marriage, being employed decreases the odds of being poor or on TANF, our logistic regression results with respect to marriage tended to be inconclusive. Although marriage decreases our respondents' odds of being eligible for TANF in 2000, the effect disappears once we include measures of employment and job characteristics. In our regression models, marriage has no effect on whether respondents are poor in 2000. However, using predicted wages to simulate the effect of marriage indicates that marriage, if possible, to an "average" earner does reduce the odds of both TANF eligibility and poverty. Marriage to spouses with low wages, as predicted by Heckman models, does not significantly change the proportion in our sample that is poor or eligible for TANF. On the other hand, even employment in low-wage jobs for less than 40 h per week would significantly reduce the proportion poor/eligible for TANF among currently single women in our sample.

The results from the Louisiana Welfare Study are similar to the results of Sigle-Rushton and McLanahan's (2002) analyses of respondents from cities with 200,000 or more people. This suggests that our findings are robust. However, we cannot apply these results beyond welfare recipients in selected Louisiana parishes. Future work with nationally representative samples or statewide data from the post-AFDC era would better address the need for information about the potential effects of marriage promotion among current or potential welfare recipients.

At this point, our findings suggest that, if possible, marriage does reduce both TANF rolls and the percent of families in poverty. From a policy perspective, however, encouraging women's employment still appears to be a more effective means of achieving caseload reduction and decreasing poverty rates. The effects of employment in our models are larger and, in general, better understood. Marriage may have unobserved effects, including possible effects on mental well-being, who provides childcare, and stress related to labor force participation. Adding to the uncertainty of marriage effects is the relationship between women's marital status and labor force activity. If marriage encourages women's labor force exit, it may have detrimental long-run effects on poverty status. Given the uncertainty about the effects of marriage in the long-run and the stronger effects of employment in our models, it would be prudent to obtain more knowledge about the way that marriage, as well as divorce, play out for the poor before designing programs that promote marriage. In any event, our results suggest that marriage promotion should not be pursued if it diverts resources away from helping current and former welfare recipients find quality jobs.

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