CHAPTER 18

Economic Demography

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There is a long tradition of research on population and economics. The work of Thomas Malthus is well known, but other early economists, including William Petty and William Godwin, were also concerned about the economic effects of population growth. Interest in the links between population and economics was rekindled during the Great Depression and was featured prominently in the writing of John Maynard Keynes. Rapid population growth during the second half of the 20th century led to renewed interest in the development effects of population growth. The consequences of population aging have emerged as an active research area as countries have entered the later stages of the demographic transition.

In contrast to the long-standing interest in the economic consequences of demographic change, there has been a more recent explosion of interest in demographic behavior. Few economists recognized the applicability of economic models to the kinds of social behavior that traditionally have been the bread and butter of sociologists and social demographers. Influenced most by the work of Gary Becker, economists are increasingly interested in marriage, divorce, childbearing, sexual behavior, and other social activities.

The broad reach of economic demography presents a considerable challenge for any effort to summarize the field. Since Spengler (1959) summarized economics and demography over 40 years ago, research has advanced on many fronts. This chapter will not attempt a comprehensive summary of this progress, however. The approach taken here is to identify some of the central ideas that are common to the field—in the section on conceptual frameworks—and then to focus in more detail on two important areas,

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intergenerational transfers and population and development, in the section on theoretical models. This approach is employed, in part, because of the successful cross-fertilization of the approaches of economists, sociologists, and social demographers. Thus, it is safe to assume that the economic approach to many demographic issues is represented throughout this volume, in chapters devoted to fertility, mortality, and migration, for example. Those who are interested in a more detailed treatment of economic approaches to these subjects would also find the *Handbook of Population and Family Economics* (Rosenzweig and Stark 1997) to be useful.

CONCEPTUAL FRAMEWORKS

Economics can be divided into microeconomics and macroeconomics. Microeconomics is concerned primarily with the behavior of economic actors—firms, households, and individuals. Traditionally the aspects of individual behavior attracting the attention of economists were consumer behavior, investment behavior, and labor force behavior. Now childbearing, marriage, divorce, health-seeking behavior, sexual behavior, criminal behavior, and many other aspects of human behavior are routinely addressed by economists.

The microeconomics framework focuses on exchange. Each individual has resources at her disposal that come primarily in two forms—financial or material wealth and time. The individual exchanges her economic resources for goods and services to achieve the highest possible level of utility. The exchange can take many forms: time can be traded for money through work; financial resources can be traded for consumer goods and services; current resources can be traded for future resources, and so on. The terms under which exchange takes place is governed by prices (or wages) that are set in the marketplace in some circumstances but may be implicit in other circumstances.

The same principles that govern traditionally modeled forms of exchange apply to demographic behavior. Marriage can be modeled as an agreement between two individuals to exchange time, material resources, and love. Childbearing requires the exchange of time and goods for children. Migration involves exchange of the lost wages in the place of origin and the direct costs of moving for the new (and hopefully higher) wages in the place of destination. Age at death turns, in part, on decisions regarding the allocation of scarce resources among competing ends.

Although many economists have contributed to the economics of demographic behavior, Gary Becker has played a pivotal role. His book, *A Treatise on the Family* (1991), and his Nobel lecture (Becker 1993) provide a valuable exposition of the application of economics to demographic behavior.

Macroeconomics is concerned with longer-term aggregate growth and with shorter-term fluctuations in the economy, e.g., the rates of inflation and unemployment. Macroeconomic demography has focused primarily on the longer-term issues, although the effects of economic fluctuations on vital events—fertility, mortality, migration, divorce, and marriage—have received some attention by economists. By and large demographic variables are not thought to influence short-run fluctuations in the economy, in part because demographic variables, e.g., age-structure and population size, change much more gradually than the economic variables, e.g., the rate of inflation or the unemployment rate.

The distinction between macroeconomics and microeconomics has blurred over time. Increasingly, macroeconomic models are based implicitly or explicitly on the aggregation of individual responses. Some macroeconomic theories are based on the behavior of a representative agent, but many models acknowledge heterogeneity within the population. In particular, macroeconomic models recognize the dependence of behavior on age. An early example is the life-cycle saving model, which assumes that saving rates vary by age and thus aggregate saving is influenced by population age structure.

Samuelson (1958) developed a particularly influential macroeconomic model that addressed important issues that arise with intergenerational transfers. His model incorporates age structure and a population consisting of overlapping generations. Since this early effort, overlapping generation models have become part of the standard toolbox of macroeconomics and, as a result, demography and economics have become more closely linked.

Some of these models, including Samuelson's, are highly stylized in their treatment of demographic conditions and processes. It is not uncommon, for example, for populations in their models to consist of only three age groups. Often models assume that the death rate is the same at all ages—an interesting assumption as it implies that life expectancy does not decline as a cohort ages! These models typically sacrifice realism in order to achieve analytic tractability. Other macroeconomic models incorporate more realistic demography. Examples include Auerbach and Kotlikoff's (1987) study of U.S. fiscal policy, Lee's (1994b) model of intergenerational transfers, the Cutler et al. (1990) study of aging and U.S. economic growth, and the Boucekkine, de la Croix, and Licandro (2002) study of human capital, demographic change, and endogenous growth to name a few.

THEORETICAL MODELS

Two areas of research are emphasized in this section: intergenerational transfers and population and development. These areas are important and illustrate the application of economic theory to demographic issues.

Intergenerational Transfers

During the last two decades there have been enormous strides in measuring, modeling, and assessing the implications of intergenerational transfers at both the micro and macro levels. This research is important, in part, because all human populations have extended periods of dependency at the beginning of their lives. Human survival requires large transfers from adults to children. Increased transfers to children in the form of spending for health and education have played an essential role in modern economic development. As life expectancy has increased, an extended period of dependency has also emerged at older ages, and intergenerational transfers from working-age adults to the elderly have become increasingly important.

Economic research has laid a strong foundation for studying intergenerational transfers at the macro level. Following on the pioneering work of Samuelson (1958) and Willis (1988), a theoretical transfer framework has been developed by Lee and his

collaborators (Bommier and Lee 2003; Lee 1994a, 1994b), which is discussed in detail in the "Research Exemplar" section below. "Generational accounting" is being used to evaluate the effects of public policy on future generations in many countries around the world (Auerbach, Gokhale, and Kotlikoff 1991; Auerbach, Kotlikoff, and Leibfritz 1999).

Significant advances at the microlevel have also been achieved. The increased availability of surveys and microlevel studies has greatly improved our ability to measure familial transfers and to discover why they occur (Altonji, Hayashi, and Kotlikoff 2000; Frankenberg, Lillard, and Willis 2002; Lillard and Willis 1997; McGarry and Schoeni 1997). Progress has been made in estimating and modeling bequests, a difficult issue (Attanasio and Hoynes 2000; Brown and Weisbenner 2002; Poterba 2000; Poterba and Weisbenner 2001). There have been important advances in modeling the allocation of resources within households, a step critical to estimating intrahousehold, intergenerational transfers (Deaton 1997; Lazear and Michael 1988). New innovative surveys are beginning to shed additional light on this issue (Chu 2000; Hermalin 2002).

The importance and form of transfers varies considerably from country to country and over time in individual countries. Almost universally, transfers from working-age adults to dependent children occur within households, although the extent to which education and health expenditures on children are privately or publicly funded varies considerably.

The situation is quite varied with respect to transfers to the elderly. Outside the industrialized countries of the West, most elderly coreside with their adult children. In Japan and South Korea, the extent of coresidence has declined very rapidly in the last few decades, but roughly half of the elderly live with children. In other Asian countries the great majority of elderly live with their children, and there is a surprising degree of stability in the aggregate. Taiwan is experiencing a gradual shift away from such arrangements, but in many other Asian countries this is not the case (East-West Center 2002). In Singapore, for example, 85% of those 60 and older lived with children in 1995 as compared with 88% in 1988, despite extraordinary economic and social change in virtually every other dimension of life (Kinsella and Velkoff 2001). The situation in Latin America is less thoroughly documented, but data for six Latin American countries show that living in multigeneration households has been the norm there as well (Kinsella 1990).

Extended living arrangements are less important in the West, but in some European countries the elderly are not living exclusively by themselves or with their spouses. In Greece and Spain, roughly 40% of those 65 and older were living in households with three or more persons. At the other extreme, only about 5% of the elderly of Sweden and Denmark lived in households with two or more persons (Kinsella and Velkoff 2001). In the U.S., the great majority of elderly do not live with their children, but this has not always been the case. The percentage 65 and older living with children in the U.S. declined from 64% in 1880 to 49% in 1940, 30% in 1960, and 18% in 1980 (Ruggles 1994). Given the importance of familial transfers, the intense focus by economists is hardly surprising.

FAMILIAL MODELS OF IG TRANSFERS. Economic models of familial intergenerational transfers emphasize two motives. First, transfers may occur to satisfy distributional objectives. Altruistic models are based on the assumption that individuals care about

others within the family (Becker 1974; Becker and Tomes 1976). Intergenerational transfers arise because parents care about their children (downward altruism), because children care about their parents (upward altruism), or both (two-sided altruism).

Second, transfers may be a nonmarket transaction between family members or others in a society. In this instance transfers involve an implicit contract or a *quid pro quo*. The form of these transactions can be relatively straightforward or quite complex. For example, grandparents may provide child care for their grandchildren and receive room and board, or adult children may provide personal care to their elderly parents with the understanding that they will receive a bequest. Parents may send their children to an expensive university with the understanding that, in return, they will receive old-age support from those children. When families insure their members against a variety of risks, this is also a form of exchange. Children may insure their parents against longevity risk. If parents die at an unexpectedly young age, children receive a bequest. If parents live longer than expected, outliving their resources, children provide support.

These alternative perspectives have led to a variety of hypotheses about why intergenerational transfers vary within and across societies and over time. If distributional objectives are important, changes in the distribution of earnings or implementation of public transfer programs will elicit changes in familial transfers. If nonmarket transactions are important, the development of market-based or public sector alternatives may lead to a diminished role for family-based transfers.

Barro (1974), Becker (1974, 1991), and Becker and Tomes (1976) develop altruistic models of intergenerational transfers that have been especially influential. In Barro's model, the behavior of individuals is guided by a utility function that is increasing in one's own consumption and the utility achieved by one's offspring. The utility of the offspring depends, in turn, on their own consumption and the utility of their offspring. Through this interlinking chain the current generation consumes and transfers resources to its children and is influenced by its concern, not only for its own children, but for all future generations.

An important implication of Barro's model is that familial transfers will neutralize fiscal policy. When a government exercises expansionary fiscal policy it stimulates the economy by increasing current spending financed by issuing debt. From the perspective of intergenerational transfers, the policy is an effort to stimulate spending by transferring resources to current generations from future generations. In Barro's model, however, the public policy is undone by altruistic households. They compensate future generations by increasing their saving and accumulating wealth, exactly offsetting the increase in public debt. Barro's model implies that public intergenerational transfers and private intergenerational transfers are perfect substitutes. A change in public transfers is matched dollar for dollar by a compensating change in private transfers.

In the Becker and Tomes framework the utility of parents depends on their own consumption, the number of children, and the quality per child. Quality is determined by spending per child (i.e., downward intergenerational transfers) and by an endowment, determined in turn by public sector policies, by luck, and by genetics. In the Becker and Tomes model an increase in household income leads to an increase in spending per child, but at a decreasing rate, because parents value higher-quality children. Becker and Tomes also show that "parents tend to invest more human capital in better-endowed children" and compensate more poorly endowed children with other kinds of transfers.

The decision by parents to invest in the human capital of their children is developed further in Becker (1991). Parents have two objectives in their transfer decisions. One is to maximize the family's total wealth by investing in the human capital of its members, especially its children. The second objective is distributional—allocating resources among family members, and across generations, in accordance with the preferences governing the parents' decision-making process. Some parents may feel very altruistic toward their children and allocate a large share of family resources to them; others may be more selfish.

It would be a matter of pure coincidence if the human capital investments that maximized family wealth produced an allocation of resources that satisfied the distributional preferences of the parents. If parents were especially altruistic, they would make additional transfers to their children, perhaps through a bequest. If parents were less altruistic (or had made especially large human capital investments in their children), they would expect their children to pay them back in some form of reverse intergenerational transfer—perhaps through old age support.

Transfers to children are the centerpiece of the Becker and Tomes model, but others have emphasized other features of intergenerational transfers. The old-age security hypothesis posits that children are the old-age security plan for parents. In countries with underdeveloped capital markets, accumulating financial wealth is not a viable option. As capital markets improve, parents can rely more on saving and less on children (Willis 1980). Protection against longevity risk will lead to bequests by elderly persons who die at a young age and support by children for elderly parents who live longer than expected (Kotlikoff and Spivak 1981). Monetary transfers from elderly parents to adult children may represent repayment for services provided to parents by children (Cox 1987).

Results from recent studies show that it is empirically difficult to distinguish alternative models of transfers, that there is every reason to believe that the motivation underlying transfers will vary from one setting to the next, and that transfers will often fill a multiplicity of purposes. In studies of interhousehold transfers in Malaysia and Indonesia, no single model explains transfers. The evidence there points to exchange, insurance, and repayments for educational "loans" as important motives for transfers (Frankenberg, Lillard, and Willis 2002; Lillard and Willis 1997). Intergenerational transfer arrangements in Taiwan are consistent with a variety of interpretations—but not the use of bequests to enforce old-age support (Lee, Parish, and Willis 1994). Altonji, Hayashi, and Kotlikoff (2000) conclude that in the U.S., money transfers respond to income difference and appear to be motivated by altruism rather than by implicit exchange. Time flows from children to parents are not accompanied by money flows from parents to children. However, the very low responsiveness of transfers to intergenerational income differences is at odds with the standard altruism model (Altonji, Hayashi and Kotlikoff 1992; Altonji, Hayashi, and Kotlikoff 2000).

RESPECTIVE ROLES OF THE FAMILY AND THE PUBLIC SECTOR. Why do families get involved in some kinds of transactions and governments in others? And why does the balance between families and governments in low-income countries differ so much from that in the industrialized countries of the West? The family offers advantages for conducting transactions in realms where *identity* is important, in transactions, for example, that "involve consequences or obligations that extend over time" (Ben-Porath 1980). Families also suffer from disadvantages. Their small size limits the extent to which they can realize economies of scale in production. As insurers, families offer

protection against moral hazard and adverse selection, but family members may face highly correlated risks reducing the extent to which pooling risks offers protection to family members. The role of the family may evolve as the effectiveness of enforcement of both private and social contracts changes, as markets develop that facilitate exchange betweens strangers, as individual and family characteristics such as income influence the potential gains and costs of the family, and as risks such as those associated with death, disability, and unemployment change.

Human capital investment is one area where identity is important, both because the returns to investment in human capital depend on characteristics of individuals that are difficult to observe and because human capital investments cannot be legally secured in the same way that a lender can protect himself from default on a loan to purchase a house, for example. Thus, education loans are unavailable in many countries or available only through publicly sponsored or subsidized programs.[2] Thus, the family continues to play a prominent, though not exclusive, role in human capital investment.

One of the difficulties the family faces is enforcement. If parents make large human capital investments in their children, what assurance do they have that the children will ever pay them back? Becker and Murphy (1988) address this issue and the circumstances under which it can lead to underinvestment in children and public intervention. One possibility is that social norms may operate with sufficient force to ensure that children will repay their parents. Another possibility is that parents are sufficiently altruistic that no payback is necessary. Through bequests parents can maintain control over the intergenerational distribution of family resources throughout their lives. But if social norms are insufficient and parents are not sufficiently altruistic, parents may choose to underinvest in the human resources of their children and/or parents may receive insufficient old-age support from their children.

There are a variety of ways under these circumstances that governments may intervene to ensure a more efficient and equitable distribution of resources. Governments may impose mandatory minimal levels of education or subsidize the costs of education by providing free public schooling or by subsidizing student loans. Thus the government can either mandate the intergenerational transfer or provide the transfer itself financed through its power of taxation. Similarly, some governments are mandating that children provide old-age support to their parents. Singapore is an example. Much more frequently governments provide direct support to seniors from taxes imposed on workers. Again, familial transfers are being mandated or public transfers are being made as a substitute for familial transfers.

An alternative perspective on government activity emphasizes political power. Preston's (1984) influential work first raised the possibility that generational shifts in political power were influencing the generational distribution of public resources. Razin, Sadka, and Swagel (2002) take a more formal approach, using a voting model to address the effects of aging on the size of transfers, and concluding, based on data for the U.S. and western European countries, that a rise in the dependency ratio leads to an increase in welfare spending.

In Preston's (1984) view, "we have made a set of private and public choices that have dramatically altered the age profile of well being." Measured along a variety of

[2] A dot-com company, "My Rich Uncle," has recently established a human capital market which allows students to sell a share of their future earnings to investors. It is too early to tell whether this effort will prove to be legal and financially successful. Thanks to Ron Lee for pointing this out to me.

dimensions, U.S. elderly made substantial gains relative to children as shifts in public policy during the 1970s substantially increased the resources of the elderly at the expense of workers and their children. In the view of Becker and Murphy (1988), increased spending on the elderly during the 1970s was essentially compensation for increased public spending on education beginning in the 1920s. Becker and Murphy's "back of the envelope" calculations indicate that the rate of return received by children, who were the beneficiaries of increased public spending, substantially exceeded the rate of return, realized through old-age support, of those who financed the increase in public spending on education. From Preston's cross-sectional perspective generational inequities appear to have increased, whereas from Becker and Murphy's longitudinal perspective public spending appears to have favored younger generations.

INTERGENERATIONAL TRANSFERS AND PUBLIC POLICY. As population aging has accelerated, public policy with respect to intergenerational transfers has been the subject of an increased amount of attention by economists. One influential initiative has been the development of an accounting system—generational accounts—that provides an overall assessment of the generational effects of public policy. A second group of studies has focused more explicitly on Social Security reform.

Generational accounts were first introduced in 1991 by Auerbach, Gokhale, and Kotlikoff (1991). Generational accounts are used to evaluate current public policy from a generational perspective by comparing the net lifetime tax rate paid by different living cohorts, including the newborn generation, and the average rate paid by all future generations. For each cohort the taxes paid in each year are deducted from the public transfers received to determine *net* taxes at each age. Lifetime net taxes paid by a cohort are calculated as the present value of the net taxes paid at each age. The lifetime net tax rate is the ratio of the net taxes paid to the present value of labor income at each age during the cohort's lifetime.

For any living cohort, generational accounts are constructed—directly based on historical and projected taxes, transfers, and earnings assuming that current policy will continue unchanged. The generational account for all future generations combined is estimated indirectly, based on the debt that current generations leave for future generations to pay. The debt includes the standard national debt but also unfunded obligations that will require payments by future generations to generations that are currently alive. In 1995, for example, the estimated present value of the debt being shifted to future generations was $9.4 trillion versus a conventionally defined national debt of $2.1 trillion (Gokhale, Page, and Sturrock 1999).

Many industrialized countries face serious generational imbalances, with future generations expected to pay a substantially higher portion of their lifetime income in taxes than do current generations (Auerbach, Kotlikoff, and Leibfritz 1999). In the U.S., future generations will, on average, be required to pay 49% of their lifetime income as compared with 29% for the newborn generation (Gokhale, Page, and Sturrock 1999). Other countries face much greater generational imbalances. In the absence of reform, future generations in Japan will face a net tax rate of 386% of lifetime income as compared with 143% for the new-born generation (Takayama, Kitamura, and Yoshida 1999).

Why do countries face such large imbalances? In part, because they have accumulated large national debts. A more important source of generational imbalance is the

impact of rapid population aging combined with public programs, primarily pension and health care programs, which provide substantial transfers to the elderly. These programs impose a net lifetime tax on each generation because the rate of return available from pay-as-you-go schemes is substantially less than the rate of return otherwise available—from the stock market, for example. Thus, each dollar "invested" in these transfer schemes effectively imposes a lifetime tax on all participants. The larger the size of the elderly population, the larger the size of such programs and their accompanying tax burden. The emergence of these huge implicit debts provides the impetus for Social Security reform.

The debate on Social Security reform deals with wide-ranging issues, only some of which are directly related to intergenerational transfers. Two important issues are considered here. The first is the effect of Social Security on saving. The second is the distribution of the benefits and costs from Social Security reform.

The effect of transfer system reform on saving is important for two reasons. First, if increases in transfer programs crowd out saving, capital accumulation and economic growth are undermined. Second, if transfer programs crowd out saving, they will have less effect on the economic status of the elderly.

The evidence about the effect of public pensions on saving is drawn mainly from the experience of western industrialized countries. Gale (1998) provides a recent review of theoretical and empirical issues. Whether Social Security transfer programs will depress saving rates was first explored by Feldstein (1974) and Munnell (1974), but the empirical evidence is quite mixed. Large effects have been estimated by Feldstein (1996), Gale (1998), Leimer and Richardson (1992), and Munnell (1974). Smaller offsets or mixed results are found by Bernheim and Levin (1989), Hubbard (1986), Hubbard and Judd (1987), King and Dicks-Mireaux (1982), and Dicks-Mireaux and King (1984). Some studies have concluded that Social Security does not depress saving at all or that the relationship is weak (Blinder, Gordon, and Wise 1980; Gullason, Kolluri, and Panik 1993; Leimer and Lesnoy 1982). Recent studies have considered the effect on saving of major reform, i.e., substantial privatization, of Chile's public pension system and concluded that the result was a substantial increase in saving rates (Coronado 2002; Holzmann 1997).

The Social Security–saving literature often neglects the possibility that changes in Social Security or other public transfer programs will induce a response in familial transfers rather than in private saving. As was first pointed out by Barro, this would neutralize the effect of public transfers on saving and capital (Barro 1974). To the extent that elderly do not make transfers to their children or, if they do, make them for exchange purposes (that is, in exchange for attention and assistance from their children), then the Barro argument would not apply. There is an extensive but inconclusive literature on these issues (see, for example, McGarry and Schoeni 1997).

Many of the current reform schemes propose phase-out of pay-as-you-go (PAYGO) Social Security and replacement with funded, privatized schemes. A contentious issue has been the extent to which establishing PAYGO systems or phasing them out benefits some generations at the expense of others. Some researchers have a quite optimistic take on this issue (Feldstein and Samwick 2001; Krueger and Kubler 2002), while others believe that any reform will require substantial redistributions. Transfer systems for old-age support generate large transfer wealth and corresponding implicit debts. The wealth is held by those now alive and is compensation for support provided to previous generations of retirees. The debt is owed by future generations.

The size of the implicit debt is very substantial. For the U.S. in the year 2000, the implicit debt (discounting at 3%) generated by Social Security (OASI) amounts to 1.7 times GDP, or 17 trillion, which is 46% of the total demand for wealth (Lee, Mason, and Miller 2003). Feldstein (1997: 9) estimates an implicit debt that is slightly lower. Many Latin American public pension programs also have large implicit debts. Bravo (2001) estimates implicit debt to GDP ratios arising from public pension program *circa* 1990 of 1 for Costa Rica, about 1.5 for Chile, Panama, and Cuba, about 2 for Brazil, and about 3 for Uruguay and Argentina. Familial transfer programs may also have large implicit debts. For Taiwan in 1960, the implicit debt generated by the family transfer system, as modeled by Lee, Mason, and Miller (2003), was about 0.9 times GDP.

If the obligations implicit in transfer systems are not honored, the costs of transition are borne entirely by those who are currently alive and fall most heavily on those who have already retired. If obligations are honored, the implicit debts must be repaid during a transition toward individual responsibility, prolonging the effects of the transfer system past the system's dissolution. Generations responsible for repaying the implicit debt face a double task: to make payments out of current income to honor past obligations by repaying the implicit debt and to save out of their current income to prefund their own retirements.

The size of the implicit debt varies considerably over the demographic transition and is strongly affected by the final stage of population aging. If the U.S. maintains its current Social Security system, the implicit debt relative to GDP will double between 2000 and 2100 due to population aging. The cost of delaying reform is substantial (Lee, Mason, and Miller 2003).

Population and Development

Economic research addresses many dimensions of development, e.g., economic structure, urbanization, social and institutional development. Recent research on population and development has emphasized a narrower concern—growth in income per capita (or per worker). A simple identity offers a device for organizing discussion of this literature. Income per capita can be expressed as the product of two terms, income per worker and the number of workers per capita: $Y/N \equiv Y/L \times L/N$. Expressed as growth rates, we have:[3]

$$\dot{y} \equiv \dot{y}^{l} + l - n \tag{1}$$

where $\dot{y}$ is the rate of growth of per capita income, $\dot{y}^{l}$ is the rate of growth of income per worker, l is the rate of growth of the labor force, and n is the rate of population growth. Growth in income or output per *worker*, the first term on the right-hand side of equation (1), has been the focus of most research on economic growth. Several recent studies extend analysis to growth in per capita income and the gap between labor force growth and population growth, $l-n$.

These studies explore what is known as the *demographic dividend*. We will discuss this recent literature first and then consider the effect of demographic factors on income or output per worker.

[3] This expression is obtained by taking the natural log of both sides and then the derivative with respect to time.

THE DEMOGRAPHIC DIVIDEND. The demographic transition is accompanied by an extended period during which the labor force grows more rapidly than the population. This generalization does not hold for all countries, but it does for many. The pattern can be seen in Figure 18.1, which plots the annual rate of growth of the labor force and the rate of growth of the population for countries of the world from 1960 to 1990 (Mason 2001a). The differences between the two growth rates are marked by diagonals in the figure.

In the countries early in their demographic transitions, the population growth rate and the labor force growth rate are both high and $l-n$ is close to zero. But as the demographic transition proceeds, the population growth rate declines more rapidly than the labor force growth rate and a gap emerges between the two—$l-n$ turns positive. Toward the end of the demographic transition, the gap becomes smaller and may turn strongly negative as population growth becomes increasingly concentrated among older age groups. The demographic dividend could then become a demographic burden.

If growth in output per worker is unaffected by the demographic transition, changes in $l-n$ yield equal changes in the rate of growth of per capita income—a demographic dividend. The effect is small in any one year but it persists for several decades. The global pattern shown in Figure 18.1 is for 30-year periods. A value of 0.5% per year for 30 years yields an increase in per capita income of 16%; a value of 1.0% per year for 30 years yields an increase in per capita income of 35%. Given that real per capita income growth for the world averaged 1.9% between 1960 and 1990, the demographic dividend potentially could explain a substantial portion of world economic growth.

Two sets of issues about the demographic dividend are immediately apparent. First, what accounts for the dividend and why is it higher in some countries than in others? Second, does the demographic dividend necessarily lead to higher growth in per capita income?

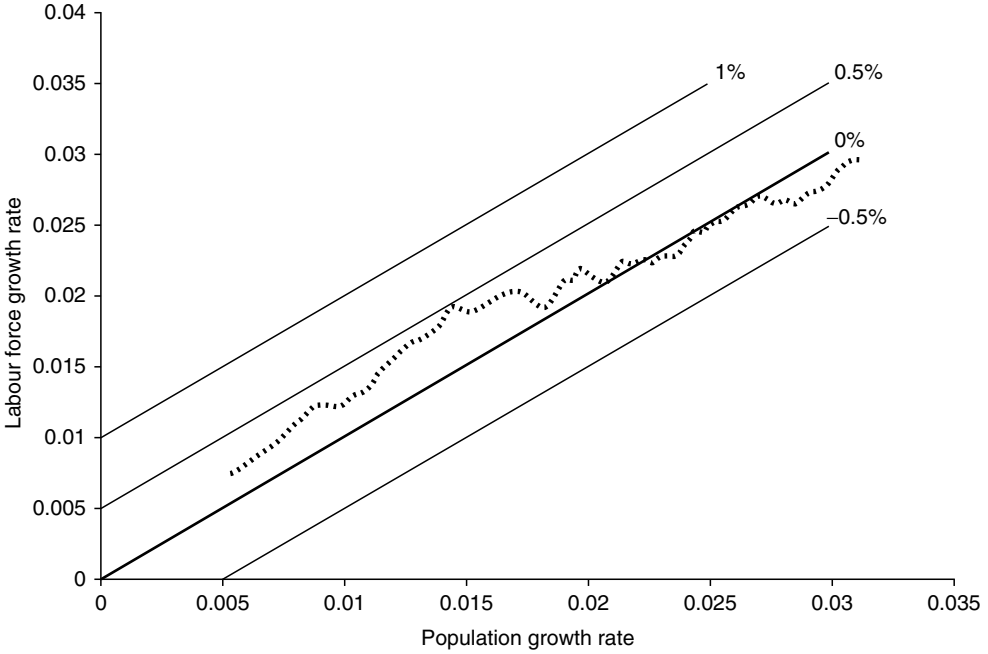

FIGURE 18.1. Population and labor force growth, 1960 to 1990. Note: Diagonals represent l−n. Source: Mason 2001a.

The labor force grows more rapidly than the population during the demographic transition for two reasons—favorable changes in age structure and, in some countries, increased female labor force participation.[4] The age structure effects can be substantial. An increase of 10 points in the percentage of the population in the working ages is not uncommon. The largest swings in the population age structure are found in countries that experience rapid fertility decline, such as those in East Asia. Slow demographic transitions, e.g., those that characterized many European countries and the U.S., produced modest swings. Latin American demographic change produced intermediate swings (Lee, Mason, and Miller 2001a).

Measured patterns of female labor force participation vary widely from region to region, reflecting differences in social, economic, and demographic conditions, differences in culture, but also differences in definition and data collection methods, especially in countries with large agricultural and informal sectors. In the 1960s and 1970s female labor force participation increased very substantially in the industrial market economies. Bloom and Freeman (1987) show, however, that for other major national groupings (low-income and, middle-income developing countries and major regional groupings) female labor force participation grew slowly or declined. In several highly successful East Asian economies rising female labor force participation rates had an important effect on labor force growth (Okunishi 2001).

The second question raised above is whether the demographic dividend automatically leads to more rapid growth in per capita income? Equation (1) is an identity, and there is no doubt that it holds. However, changes in population growth and labor force growth (and related demographic changes) may lead to changes in the growth of output per worker that either offset or reinforce the effects of the demographic dividend.

Analysis of output per worker has been greatly influenced by Solow's article on economic growth (Solow 1956). His neoclassical growth model describes a simple economy in which production is determined by the size of the labor force, the amount of physical capital, e.g., machinery, structure, and roads, and the level of technology. Output per worker can increase for two reasons: because of improvements in technology or because of *capital deepening*—an increase in capital per worker.

Capital deepening occurs because of an increase in the saving rate or a decline in the rate of growth of the labor force.[5] A higher saving rate leads to more investment and an increase in the capital stock relative to the labor force. A decline in labor force growth means that fewer entering workers must be "equipped" each year so that additional capital can be diverted to capital deepening. Solow shows that an increase in the saving rate or a decline in the labor force growth rate leads only to a transitory increase in the rate of capital deepening and the rate of growth of output per worker. Eventually, the economy will stabilize with output per worker growing at the rate of technological change. Output per worker will be on a higher path because of the higher saving rate or slower labor force growth rate, but growing at a rate determined entirely by technological change.

In the neoclassical growth model, long-run growth in output per worker is independent of l or n. In the long run, however, l and n must be equal. Thus, output per worker and output per capita grow at the same rate and neither is influenced by the rate

[4] These changes are offset to some extent by reduced labor force participation by school-age children and by older workers.

[5] Solow does not distinguish between the labor force growth rate and the population growth rate in his model.

of population growth or the rate of labor force growth. The short-run is quite a different matter. Throughout the demographic transition changes in l will affect the rate of growth of output per worker. To the extent that the demographic dividend arises because of an increase in l rather than a decline in n, the positive effects of the demographic dividend will be partially offset by negative effects on growth in output per worker. The size of the offset will vary depending on economic structure, the flexibility of labor markets, the extent to which the economy is integrated into the world economy, and a host of other factors.

In the simple neoclassical growth model demographic change also influences growth in output per worker indirectly through two channels—saving and technological change. A potentially important third channel, incorporated into extensions of the neoclassical growth model, is investment in human capital.[6] There are other potentially important demographic effects but most research has focused on innovation, saving, and human capital effects.[7]

INNOVATION. In the standard neoclassical growth model, innovation is exogenous and typically assumed to raise output per worker by a constant amount each year (in the absence of capital deepening). Endogenous growth models explicitly model the development of new technology (Grossman and Helpman 1991; Lucas 1988; Romer 1990). In these models, the returns to innovation typically increase with the size of the economy. If population, labor force, the capital stock, and other production factors increase by an equal amount, the result is greater innovation and faster economic growth. Endogenous growth models have been the object of considerable attention in recent years, but some central features of these models are inconsistent with important empirical features of economic growth (Jones 1995). Consequently, it remains unclear how new efforts to model technological innovation are likely to influence understanding of the link between population growth and economic growth.

In contrast, the effect of population growth on technological innovation in the agricultural sector is well established. Given fixed technology and a fixed supply of agricultural land, the *law of diminishing returns* implies that an increase in the size of the agricultural labor force will lead to a decline in agricultural output per worker and lower agricultural wages, much in the manner originally hypothesized by Malthus.[8] The theory of induced innovation describes how agricultural practice evolves as population pressure leads to increased scarcity of agricultural land (Boserup 1965, 1981; Hayami 2001; Hayami and Ruttan 1987). In extensive studies of Asian agriculture, Hayami and Ruttan have shown that land scarcity led to the development of new high-yielding seed varieties and more intensive use of fertilizer. Output per hectare increased substantially, even though Asia is densely populated and its land heavily cultivated. Through induced innovation the law of diminishing returns is overturned—or at least weakened.

The success has been more pronounced in Asia than elsewhere. Food output per hectare increased by 2.9% per annum between 1963 and 1993 as compared with increases of 1.9% and 1.7% in Africa and Latin America, respectively, during the

[6] Mankiw, Romer, and Weil (1992) extend the model to include education or human capital. In this elaboration an increase in human capital per worker also leads to greater output per worker.

[7] See Kelley and Schmidt (2001) for a discussion of other channels through which population growth may influence economic growth.

[8] See Lee (1973) for a modern presentation of the Malthusian model and an analysis of its applicability to preindustrial England.

same period. Food output per capita achieved annual growth of 1.1% in Asia and 0.4% in Latin America, but declined by 0.2% annually in Africa (Hayami 2001: Table 4.2). Why Asia's agricultural sector adjusted so much more successfully to population growth than Africa's is an interesting issue, which we discuss in broad terms in the section on methodological challenges.

SAVING. The idea that demographic factors influence saving and investment rates figured prominently in Coale and Hoover's study of Indian economic growth (Coale and Hoover 1958). Tobin (1967) provided an important elaboration on the neoclassical growth model that incorporated the effects of demographic variables on capital and income. Leff (1969) contributed several early, but much criticized, empirical studies. Recent studies are based on one of two models—the variable rate-of-growth model (Mason 1987; 1988) and the Fair and Dominguez (1991) specification.

Stripped to their essential elements, early models hypothesized that population age structure will affect aggregate saving rates because saving varies by age. In the life-cycle model, for example, working-age adults save in anticipation of retirement while the elderly dis-save in order to finance their retirement (Modigliani and Brumberg 1954). The Fair-Dominguez specification is based on the assumption that important variables, including the saving rate, can be described by a fixed age-saving profile. If saving varies by age for any reason, changes in age structure will influence the aggregate saving rate.

The variable rate-of-growth model (Mason 1987, 1988) is a more general formulation in that it considers both changes in the age composition of the population and changes in the age profile of saving that are induced by demographic change or other factors. This leads to a more complex saving model in which demographic factors interact with the rate of economic growth in determining the aggregate saving rate.

Several recent empirical studies have examined the population-saving link. Based on analysis of aggregate saving data, Kelley and Schmidt (1996), Williamson and Higgins (2001), and Toh (2001) conclude that changes in age-structure have had a very large effect on saving rates. Kelley and Schmidt find that the effects are greater in countries with rapidly growing economies as hypothesized by the variable rate-of-growth model, whereas Williamson and Higgins do not find a significant interaction. Deaton and Paxson (2000) employ a different empirical strategy, using household survey data to estimate age profiles of saving and simulating the effect of changing age structure using a variable rate-of-growth specification. They conclude that changes in age structure had an effect on saving rates but one that was more modest than found in studies of aggregate saving. Lee, Mason, and Miller (2000, 2001a, 2001b) simulate both changes in age structure and changes in age-profiles and reach an intermediate conclusion about the possible effects of changes in age structure.

In summary, the most recent evidence supports a link between demography and saving. According to these estimates the demographic dividend has led to higher saving rates. This would have boosted growth in output per worker and reinforced the effect on per capita income of the increase in $l-n$ in equation (1). The magnitude of the effect, however, remains a subject of controversy.

HUMAN CAPITAL. There is extensive research on the contribution of human capital, education, and health to economic growth and the links to demographic variables. The literature is more diverse than the literature on saving and investment, but the

neoclassical growth model can provide a useful conceptual framework. Mankiw, Romer, and Weil (MRW) (1992) take such an approach using secondary school enrollment as a proxy for investment in human capital. They conclude, as have many others, that increased investment in human capital yields high returns. The importance of health to economic development has also been firmly established, most recently by the WHO Commission on Macroeconomics and Health (World Health Organization 2001).

Most economic research on the links between demography and human capital investment are carried out in the fertility decision-making framework discussed in some detail above. In this framework, the number of children and investment in their human capital are jointly determined by changes in income and prices. A decline in the number of children does not *cause* an increase in human capital investment.

Of course, not all changes in childbearing reflect parental choice and, to the extent that unwanted births occur, they will, in the Becker framework, lead to a decline in expenditures per child. In a recent innovative approach Jensen and Ahlburg (2001) analyze the effects of unwanted births on health outcomes. They find that in two relatively low-income countries, the Philippines and Indonesia, where the trade-offs are harsher, unwantedness led to substantial increases in morbidity. In South Korea, where incomes are much higher, no measurable effects were found.

An alternative approach focuses on human capital investment in women of childbearing age rather than on children. Declining child mortality has reduced the reproductive burden on women, and contraceptive innovations have increased their ability to regulate fertility. As a result of these and other changes, women have increased their participation in the formal labor force, where rewards are more closely linked to education. This has increased the incentives for women to invest more in education. The U.S. experience in this regard is described by Goldin and Katz (2002) in a study highlighted in the ''Research Exemplars'' section.

There are a number of comprehensive reviews of the literature on the connection between demography and human capital (Ahlburg and Jensen 2001; Kelley 1996; Montgomery and Lloyd 1996).

THE BOTTOM LINE. Several recent studies have attempted estimates of the demographic dividend—the total contribution to growth in per capita income of changes in demographic factors. Although studies differ in their methodological approaches and in their details, the conclusions reached are broadly consistent. Bloom and Williamson (1998) conclude that demographic change between 1965 and 1990 accounted for about one-third of the growth in per capita income in developing countries. Mason (2001a) concludes that demographic factors accounted for 28% of Taiwan's growth in per capita output between 1965 and 1990. Kelley and Schmidt (2001) conclude that ''fertility and mortality changes have each contributed around 22% to changes in output growth between 1965 and 1990. The evidence supports the view that the demographic transition has played an important, positive role in economic development.

METHODOLOGICAL CHALLENGES

An important methodological challenge for research on intergenerational transfers is to develop data and theoretical models that will support a broader and more

comprehensive policy debate. Current policy research focuses almost exclusively on public transfers and primarily on public pension reform. The limited scope of the current policy debate is regrettable for two reasons. First, in some countries family support systems are eroding, and other countries may soon face similar trends. Second, familial transfers and public transfers are related—in some respects they are substitutes for each other. Thus, the effect of changes in public transfer policy depends in part on the response of familial transfers. The possibility that public support for the elderly might merely supplant family support has long been appreciated. However, current research efforts are focused almost entirely on family transfers or public policy and not the interaction between the two.

While it may seem unusual to think of family transfer programs as a policy variable, many governments are interested in maintaining and strengthening the family support system. Some countries have pursued explicit policies. Singapore passed the Maintenance of Parents Act in 1996, which established legal responsibilities of adult children for their parents (Singapore 2003). Under these circumstances it is as important to consider the implications of reform to familial support systems as to public support systems.

One of the recurring themes in research on population and development is that the economic, physical, and policy environments condition the effects of population change on economic growth. This was one of the important conclusions reached in the U.S. National Research Council's study of population and development undertaken in the mid-1980s (Johnson and Lee 1987). More recent studies have reinforced this conclusion (Ahlburg, Kelley, and Mason 1996; Bloom, Canning, and Sevilla 2002; Mason 2001b).

These studies show that a broad range of policy variables may *in principle* influence the development effects of population change, but the challenge remains to provide convincing empirical evidence on which set of policies will allow countries to exploit the demographic dividend.

RESEARCH EXEMPLARS

In this section, the major themes and methodological approaches of economic demography are illustrated through a more extensive discussion of two recent studies. The first, by Goldin and Katz (2002), considers how the development of oral contraceptives and the evolution of the U.S. legal system influenced education and marriage decisions by women. The second, by Lee (2000), develops a new method for analyzing intergenerational transfers and employs it to contrast traditional and modern industrial societies.

Claudia Goldin and Laurence F. Katz, "The Power of the Pill: Oral Contraceptives and Women's Career and Marriage Decisions"

Many observers have argued that the development of modern contraceptives, particularly the pill, has had an enormous influence on the lives of women in the U.S. The general point has been made, but there is surprisingly little solid empirical evidence about the effects of the pill—at least in research by economists. The reason in part is the difficulty in analyzing the effects of singular events. There is a before and an after, but the influence of any innovation is not felt immediately. Rather, they diffuse through a society at a pace that may be hindered or abetted by social norms, the legal system, and

other institutions. Some groups may respond rapidly to new possibilities, while others may be very resistant to change. The Goldin and Katz (2002) paper is interesting both for its conclusions but also for its approach to such a difficult issue.

Goldin and Katz hypothesize that the development of the contraceptive pill reduced the costs of delaying marriage and pursuing long-duration professional education. This led to a rise in the age at marriage, an increase in premarital sexual activity, and an increase in the proportion of women pursuing advanced degrees and, subsequently, practicing in law, business, medicine, dentistry, and other professions.

The U.S. Food and Drug Administration approved the use of norethynodrel (Enovid) as an oral contraceptive for women in 1960, and its use quickly spread among married women. The use of the pill by single women spread much more slowly, however, because of legal and social impediments regarding the use of contraception by single women, particularly those who were minors. In 1969, the age of majority was 20 or older in 43 of the 50 U.S. states, and in all but a few states contraceptive services could not be provided to minors without parental consent. These laws were not strictly enforced and were sometimes circumvented, but contraceptive services were not readily available to single women. University health services, for example, did not offer contraceptives to all of their students until 1969 and later.

In 1971 the 26th Amendment to the Constitution was ratified, lowering the voting age from 21 to 18. The number of states with an age of majority of 20 or older declined to 32 in 1971 and to only 7 in 1974. In 1974, 27 states allowed women 16 or younger to obtain contraceptive services without parental consent as compared with only three states in 1969. In the view of Goldin and Katz, it was the new technology working in concert with the changing legal and social environment that affected the behavior of young single women.

Goldin and Katz propose a simple marriage model. Suppose the population consists of equal numbers of men and women who are unmarried but can marry either in period 1 or period 2. If woman i marries man j in period 1 the women gets Y_i (from her husband) and the man gets N_j (from his wife). If marriage is delayed until period 2, the gains from marriage for both the husband and wife are augmented by $\alpha_j - \lambda_0$, where α_j is the additional amount obtained if woman j delays marriage and invests in a career. And λ_0 is the cost of the delay. Through the marriage market, men and women choose their partners, the period of marriage, and whether a woman will pursue a career. Any women for whom $\alpha_j - \lambda_0 > 0$ will marry in period 2 and pursue a career. The introduction of the pill reduces the cost of delay from λ_0 to λ_p. This will induce an additional group of women to delay marriage and pursue a career. Given the lower cost of delay, these women will be more attractive marital partners and marry men with higher Y_i. Women for whom $\alpha_j - \lambda_p < 0$ will still choose to marry in the first period and forego a career. However, they will be worse off because their value in the marriage market will be diminished relative to women who choose careers, and hence they will form marital unions with men who have lower Y_i. Thus, the decline in the price of delay will lead to a higher mean age at marriage and an increase in the percentage of women pursuing careers.

Goldin and Katz call this the *direct* effect of the pill but also point to an *indirect* effect. The increase in the number of men and women postponing marriage will thicken the marriage market for those who delay marriage. The amount of information available to potential marital partners will increase, leading to a reduction of marital mismatch.

Goldin and Katz rely on a two-fold empirical strategy. First, they examine the timing of the increases in the age at marriage, premarital sex, and female enrollment in professional programs, showing that rapid increases closely followed changes in the legal environment for the nation as a whole. Second, they use a regression model to estimate the effect of restrictive laws on contraception for minors and abortion in the state of birth at the time that the individual was 18 years of age. They use a differences-in-differences specification by including dummy variables for both state of birth and year of birth. They analyze a 1% sample from the 1980 U.S. Census of women. The analysis is limited to college graduates or in some instances to women who had at least some college.

The results are quite interesting. Depending on the specification used they conclude that "improved access for minors generated a change of 24–37 percent of the 8.7-percentage-point decline" in the percentage married by age 23 that occurred between the 1940s birth cohort and the early 1950s birth cohort (Goldin and Katz 2002: 758). Improved access to the pill also has an important and statistically significant effect on the proportion of women in professional careers. "Improved pill access ... can explain an increase in the share of college women as lawyers and doctors of 1.2 to 1.6 percentage points as compared with an overall increase of 1.7 percentage points from 1970 to 1990" (Goldin and Katz 2002: 762). The development of the contraceptive pill and its increased availability to single women had a large, though not exclusive, effect on age at marriage and career choice of American women.

Ronald D. Lee, "Intergenerational Transfers and the Economic Life Cycle: A Cross-cultural Perspective"

In a series of studies, Lee and several colleagues have developed a conceptual framework for tracking intergenerational transfers at the aggregate level (Lee 1994a, 1994b; Lee and Lapkoff 1988). Lee (2000) uses that framework to analyze how transfers evolve as societies develop. He brings his analysis directly to bear on Caldwell's hypothesis that fertility declines as a consequence of the reversal in the direction of "wealth flows"—from children to parents in high-fertility societies; from parents to children in low-fertility societies.

Lee approaches the analysis and measurement of transfers indirectly. We know that transfers must occur because at some ages people consume much more than they produce. Lee considers an example of a group of Amazon Basin hunter-gather horticulturists who have been extensively studied by Kaplan (1994). Figure 18.2 charts the amount produced and the amount consumed per day, measured in calories, by the average person.

Young children are consuming much more than they are producing. Indeed, they do not begin to produce as much as they consume until they reach 20 years of age. Adults, on the other hand, are producing considerably more than they are consuming. Even those at the oldest ages are in a net surplus position. The differences between consumption and production are made up by transfers from those who are in a surplus position (adults in this case) to those who are in a deficit position (children). Among the Amazon Basin group, transfers are unambiguously in a downward direction, from adults to children.

A cursory examination of Figure 18.2 reveals that the surplus among adults appears to be substantially greater than the deficit among children. Does this mean that the total production is substantially greater than the total consumption? The

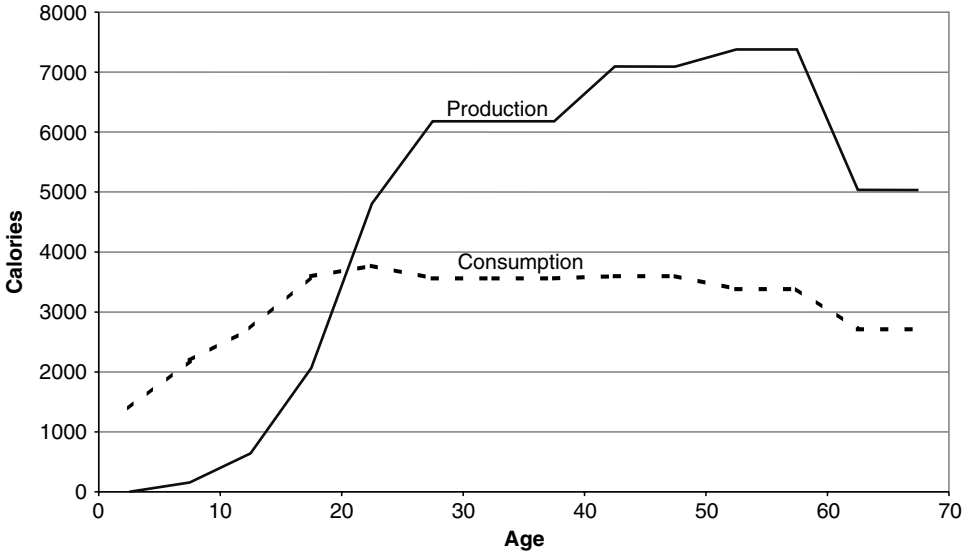

FIGURE 18.2. Interage resource reallocations for Kaplan's horticulturists (pooled). Source: Lee 2000.

answer is no. The values in Figure 18.2 are amounts per person and the age-distribution of the population is heavily weighted toward children. The weighted total consumption was equal to the weighted total of production. In hunter-gather societies there was no saving—people consumed what they produced.

The timing of production and consumption for the society can be summarized by their average ages, the population-weighted averages. For Kaplan's group the average age of consumption was 23.3 years and the average age of production was 34.3. If the average age of consumption is less than the average age of production, then transfers must be in a downward direction (Lee 1994b; Willis 1988).

Is the downward direction of transfers found for Kaplan's horticulturists typical of other traditional groups? What is the pattern for industrialized countries? Lee summarizes the results of other studies as shown in Figure 18.3. In this figure, the tail of the arrow is placed at the mean age of production and the point of the arrow at the mean age of consumption. For every preindustrial society the direction of transfers is strongly downward. For industrial societies the direction of the transfers are upward—from children to parents. The direction of transfers is upward in industrial societies because a large percentage of their populations consist of elderly who, unlike the Amazon horticulturists, are consuming substantially more than they are producing.

Lee finds that transfers reverse direction over the development process, but opposite to the direction hypothesized by Caldwell. In the high-fertility settings net transfers are from parents to children; in the low-fertility settings, from children to parents. As Lee points out, however, it is familial transfers, e.g., direct transfers between children and their parents, that matter in Caldwell's fertility theory. Total transfers include familial transfers and transfers that are effected by the state, e.g., public pensions, public education, and publicly financed health care programs. The decision by a couple to have another child might be influenced by the prospect that the child will provide old-age support to the couple, but it could hardly be influenced by the prospect that the child will pay taxes that fund programs for the elderly.

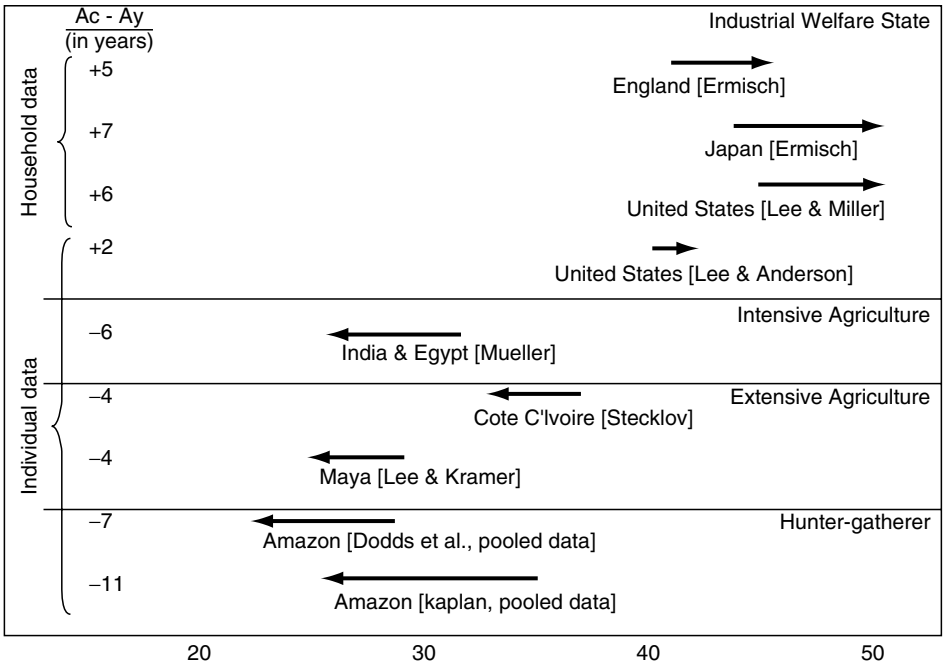

FIGURE 18.3. Summary of interage reallocations in various contexts. Source: Lee 2004.

Lee addresses this issue by separately considering public and familial transfers. In the most traditional settings, of course, all transfers are familial—or perhaps tribal or community-based. In modern Third World countries, public sectors are more developed, but in most countries they are small relative to the size of their economies. In many Latin America countries, the public sectors are larger because of the importance of public pension programs. In any event, however, most transfers are familial transfers and the direction of those transfers is downward, from parent to child.

In industrialized countries, however, public transfers are very large and upward in direction. In the U.S., public transfers for Social Security, Medicare, and Medicaid dominate familial transfers and account for the upward flow of total transfers. Figure 18.4 provides Lee's estimates of familial transfers in the U.S. Interhousehold transfers include bequests and *inter vivos* gifts and transfers. Intrahousehold transfers distinguish spending on higher education from other child costs. For each category Figure 18.4 shows the annual net transfer per household in the case of interhousehold transfers and per child in the case of intrahousehold transfers. The arrows point in the direction of the transfers and extend from the average age of the provider of the transfer to the average age of the recipient of the transfer, where the average ages are dollar weighted. Although total transfers in the U.S. are in the upward direction, familial transfers are in the downward direction. Based on the evidence available to this point, there is no reversal in familial transfers.

FUTURE PROSPECTS

The future of research on population economics will depend, first, on the environment in which research is conducted and, second, on the substantive issues of the day.

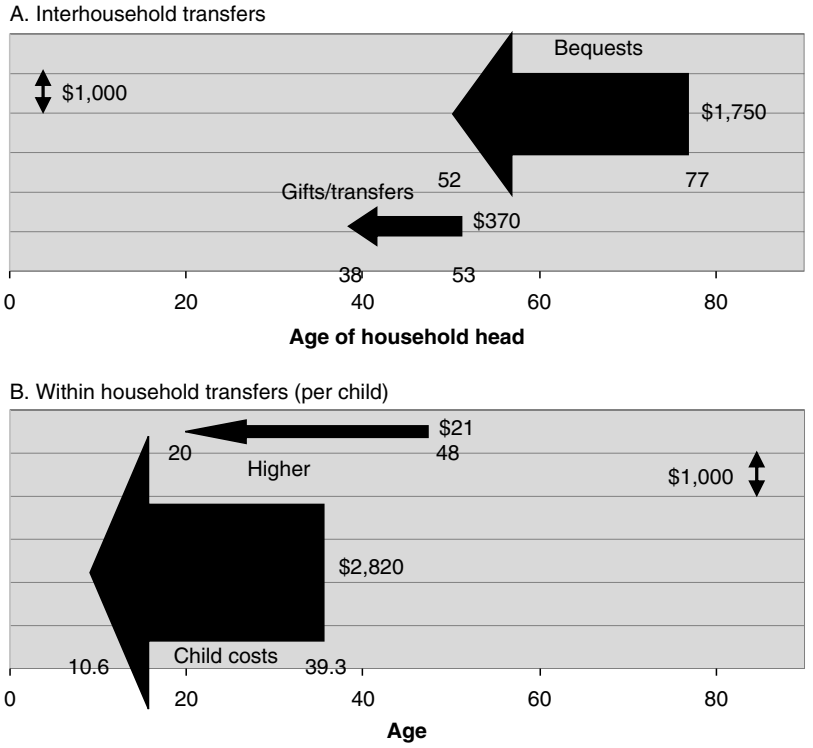

FIGURE 18.4. Familial transfers in the U.S.

Turning first to the research environment, our ability to store, process, and share information is improving with remarkable speed. Many aspects of research are influenced by these developments. The complexity of models used by researchers has increased enormously. Economists are making greater use of microsimulation models and complex macrosimulation models. These approaches are providing a better understanding about heterogeneity and stochastic processes, for example.

Comparative research is facilitated by our ability to process large amounts of data at a low cost and also by the ease with which researchers around the globe can communicate and thus collaborate. The future holds rich possibilities for large, multicountry, collaborative efforts that should increase our understanding of how culture, history, and social and economic institutions condition the connections between economy and demography.

Perhaps the ease with which information is shared has encouraged more multidisciplinary research. If so, the future may hold more fruitful collaboration between economists and sociologists, historians, anthropologists, geographers, and physical scientists.

An important negative development has to do with the acquisition of information. Conducting surveys has become increasingly expensive and difficult in the West. Moreover, the environment for carrying out survey research is becoming increasingly restrictive. At some point in the future, impediments to collecting data may have a great influence on the kinds of research that we conduct.

No doubt the chapters in this volume identify many of the same issues that will be addressed in population research during the coming decades. Each of these issues has economic dimensions. Any short list would no doubt include the following:

1. Low fertility and possibly persistent subreplacement fertility
2. Continued improvements in life expectancy, perhaps to very high levels
3. Decline in the institution of marriage
4. Population aging
5. Population stabilization and decline
6. Recurring health crises
7. Changing reproductive technology
8. Shifting regional patterns

Three questions that are likely to attract more attention in future research on population and economics are:

1. How will developing countries adapt to the rapid and early aging that they are likely to experience?
2. Will the economic effects of aging be different when aging becomes a global rather than a regional phenomenon?
3. Will regional population shifts influence globalization forces over the coming decades?

Compared with western industrialized countries of the world, population aging in Latin America and Asia will be very rapid and occur at relatively low levels of development. How will this influence the ability of these countries to achieve generational equity and some modicum of economic security for the elderly? Perhaps the most important and complex task for these countries is to develop adequate political and economic institutions. Public pension programs are subject to political risk, for example, which in some settings undermines the effectiveness with which they can provide economic security to a growing elderly population. In a similar vein, the development of well-functioning, reliable financial markets is essential if the private sector is to provide a viable alternative to public pension programs. The financial crises in Latin America during the 1980s and in Asia in the 1990s provides ample testament to the fragility of personal wealth. The extended family continues to play a very important role in many countries, but is this a viable and sustainable approach to old-age security?

To this point population aging has been more of a national or regional phenomenon than a global one. The percentage of the world's population 65 and older increased only modestly during the last five decades, from 5.2% in 1950 to 6.9% in 2000. The U.N.'s low variant projection anticipates a much more substantial increase to 18.5% by 2050 (United Nations 2000). To an important extent the effects of aging in the industrialized West have been moderated by the emergence of a well-integrated global economy. The effects of worker shortages in the West, for example, are moderated by shifting production to China, India, and other countries with large working-age populations. But when China and India no longer have large growing workforces, how will their economies and the economies of the West be influenced by global population aging and population decline?

This brings us to the third issue: the relationship between regional population difference and globalization. The second half of the 20th century and the first half of the 21st century have been periods during which regional demographic shifts have been

especially large. The More Developed Region's (MDR)[9] share of the world's population will decline from 32.3% in 1950 to 13.7% in 2050 under the U.N.'s low scenario. Equally dramatic are the shifts in age structure. The share of the working-aged population (15 to 64) is projected to rise from 55.0% in 1975 to 66.2% in 2050 in the Less Developed Region (LDR) while declining from 65.1% to 58.3% in the MDRs. How will these regional demographic shifts—and especially shifts in global distribution of the working age population—influence the flow of goods, money, and people across international boundaries? One can easily envision greater globalization and greater interest in the processes of globalization. But as history has shown, the push toward globalization will encounter strong isolationist forces with an outcome that remains uncertain.

[9] The More Developed Region (MDR) is comprised of Europe, North America, Australia/New Zealand, and Japan.

REFERENCES

Ahlburg, D. A., and E. R. Jensen. 2001. Education and the East Asian miracle. In *Population change and economic development in East Asia: Challenges met, opportunities seized*. Edited by A. Mason, 231–255. Palo Alto, Calif.: Stanford University Press.

Ahlburg, D. A., A. C. Kelley, and K. O. Mason. 1996. The impact of population growth on well-being in developing countries. Heidelberg: Springer-Verlag.

Altonji, J. G., F. Hayashi, and L. Kotlikoff. 1992. Is the extended family altruistically linked? Direct evidence using micro data. *American Economic Review* 82(5): 1177–1198.

Altonji, J. G., F. Hayashi, and L. Kotlikoff. 2000. The effects of income and wealth on time and money transfers between parents and children. In *Sharing the wealth: Demographic change and economic transfers between generations*. Edited by A. Mason and G. Tapinos, 306–357. Oxford: Oxford University Press.

Attanasio, O. P., and H. W. Hoynes. 2000. Differential mortality and wealth accumulation. *Journal of Human Resources* 35: 1–29.

Auerbach, A. J., J. Gokhale, and L. J. Kotlikoff. 1991. Generational accounts: A meaningful alternative to deficit accounting. In *Tax policy and the economy*. Edited by D. Bradford. Cambridge, Mass.: MIT Press for the National Bureau of Economic Research.

Auerbach, A. J., and L. J. Kotlikoff. 1987. *Dynamic fiscal policy*. Cambridge, Mass.: Cambridge University Press.

Auerbach, A. J., L. J. Kotlikoff, and W. Leibfritz. 1999. Generational accounting around the world. Chicago: University of Chicago Press.

Barro, R. J. 1974. Are government bonds net worth? *Journal of Political Economy* 82(6): 1095–1117.

Becker, G. S.1974. A theory of social interactions. *Journal of Political Economy* 82: 1063–1093.

Becker, G. S. 1991. *A treatise on the family, enlarged ed*. Cambridge, Mass.: Harvard University Press.

Becker, G. S. 1993. Nobel lecture: The economic way of looking at behavior. *Journal of Political Economy* 101(3): 385–403.

Becker, G. S., and K. M. Murphy. 1988. The family and the state. *Journal of Law & Economics* XXXI (April):1–18.

Becker, G. S., and N. Tomes. 1976. Child endowments and the quantity and quality of children. *Journal of Political Economy* 84(4 pt. 2): S143–162.

Ben-Porath, Y. 1980. The F-connection: Families, friends, and firms and the organization of exchange. *Population and Development Review* 6(1): 1–30.

Bernheim, B. D., and L. Levin. 1989. Social Security and personal saving: An analysis of expectations. *American Economic Review* 79(2): 97–102.

Blinder, A. S., R. H. Gordon, and D. E. Wise. 1980. Reconsidering the work disincentive effects of social security. *National Tax Journal* 33(December): 431–442.

Bloom, D. E., D. Canning, and J. Sevilla. 2002. *The demographic dividend: A new perspective on the economic consequences of population change*. Santa Monica, Calif.: RAND.

Bloom, D. E., and R. B. Freeman. 1987. Population growth, labor supply, and employment in developing countries. In *Population growth and economic development: Issues and evidence*. Edited by D. G. Johnson and R. D. Lee, 105–147. Madison: The University of Wisconsin Press.

Bloom, D. E., and J. G. Williamson. 1998. Demographic transitions and economic miracles in emerging Asia. *World Bank Economic Review* 12(3): 419–456.

Bommier, A., and R. D. Lee. 2003. Overlapping generations models with realistic demography. *Journal of Population Economics* 16: 135–160.

Boserup, E. 1965. *The conditions of agricultural growth*. Chicago: Aldine.

Boserup, E. 1981. *Population and technological change: A study of long-term trends*. Chicago: University of Chicago Press.

Boucekkine, R., D. de la Croix, and O. Licandro. 2002. Vintage human capital, demographic trends, and endogenous growth. *Journal of Economic Theory* 104: 340–375.

Bravo, Jorge. 2001. Vieillessement de la Population et Systemes de Retraite: L'Amerique Latin dans une Perspective Internationale. *Les Dossier du CEPED* No. 62 (Paris, France, Mai)

Brown, J. R., and S. J. Weisbenner. 2002. Is a bird in hand worth more than a bird in the bush? Intergenerational transfers and savings behavior. *National Bureau of Economic Research (NBER) Working Paper No. w8753*.

Chu, C. Y. C. 2000. Panel study of family dynamics. Taipei, Taiwan: Academia Sinica.

Coale, A., and E. M. Hoover. 1958. *Population growth and economic development in low-income countries: A case study of India*. Princeton, N.J.: Princeton University Press.

Coronado, J. L. 2002. The effects of Social Security privatization on household saving: Evidence from Chile. *Contributions to Economic Analysis & Policy* 1(1): Article 7.

Cox, D. 1987. Motives for private income transfers. *Journal of Political Economy* 95: 508–546.

Cutler, D. M., J. M. Poterba, L. M. Sheiner, and L. H. Summers. 1990. An aging society: Opportunity or challenge? *Brookings Papers on Economic Activity* (1): 1–56.

Deaton, A. S. 1997. *The analysis of household surveys: A microeconometirc approach to development policy*. Baltimore and London: World Bank.

Deaton, A. S., and C. H. Paxson. 2000. Growth, demographic structure, and national saving in Taiwan. *Population and Development Review*. Vol. 26 (Supplement): 141–173.

Dicks-Mireaux, L., and M. A. King. 1984. Pension wealth and household savings: Tests of robustness. *Journal of Public Economics* 23(February/March): 115–139.

East-West Center. 2002. *The future of Asia's population*. Honolulu: East-West Center.

Fair, R. C., and K. M. Dominguez. 1991. Effects of the changing U.S. age distribution on macroeconomic equations. *American Economic Review* 81: 1276–1294.

Feldstein, M. 1974. Social Security, induced retirement, and aggregate capital accumulation. *Journal of Political Economy* 82(5): 905–926.

Feldstein, M. 1996. The missing piece in policy analysis: Social Security reform. *American Economic Review* 86(2): 1–14.

Feldstein, Martin. 1997. Transition to fully Funded Pension System: Five Economic Issues. *National Bureau of Economic Research (NBER) Working Paper No. w6149*.

Feldstein, M., and A. Samwick. 2001. Potential paths of Social Security reform. *NBER Working Paper No. w8592*.

Frankenberg, E., L. A. Lillard, and R. J. Willis. 2002. Patterns of intergenerational transfers in Southeast Asia. *Journal of Marriage and the Family* 64 (August): 627–641.

Gale, W. G. 1998. The effects of pensions on household wealth: A reevaluation of theory and evidence. *Journal of Political Economy* 106(4): 706–723.

Gokhale, J., B. R. Page, and J. R. Sturrock. 1999. Generational accounts for the United States: An update. In *Generational accounting around the world*. Edited by A. J. Auerbach, L. J. Kotlikoff, and W. Leibfritz. Chicago: University of Chicago Press.

Goldin, C., and L. F. Katz. 2002. The power of the pill: Oral contraceptives and women's career and marriage decisions. *Journal of Political Economy* 110: 730–770.

Grossman, G., and E. Helpman. 1991. *Innovation and growth in the global economy*. Cambridge, Mass.: MIT Press.

Gullason, E. T., B. R. Kolluri, and M. J. Panik. 1993. Social Security and household wealth accumulation: Refined microeconometric evidence. *Review of Economics and Statistics* 75(3): 548–551.

Hayami, Y. 2001. Induced innovation and agricultural development in East Asia. In *Population change and economic development in East Asia: Challenges met, opportunities seized*. Edited by A. Mason, 96–120. Palo Alto, Calif.: Stanford University Press.

Hayami, Y., and V. W. Ruttan. 1987. Population growth and agricultural productivity. In *Population growth and economic development: Issues and evidence*. Edited by D. G. Johnson and R. D. Lee. Madison: University of Wisconsin Press.

Hermalin, A. I. 2002. The well-being of the elderly in Asia: A four-country comparative study. Ann Arbor: University of Michigan Press.

Holzmann, R. 1997. Pension reform, financial market development, and economic growth: Preliminary evidence from Chile. *International Monetary Fund Staff Papers* 44(2): 149–178.

Hubbard, R. G. 1986. Pension wealth and individual saving: Some new evidence. *Journal of Money, Credit and Banking* 18(May): 167–178.

Hubbard, R. G., and K. L. Judd. 1987. Social Security and individual welfare: Precautionary saving, borrowing constraints, and the payroll tax. *American Economic Review* 77(4): 630–646.

Jensen, E. R., and D. A. Ahlburg. 2001. Child health and health care in Indonesia and the Philippines. In *Population change and economic development in East Asia: Challenges met, opportunities seized*, Edited by A. Mason, 255–279. Palo Alto, Calif.: Stanford University Press.

Johnson, D. G., and R. D. Lee. 1987. Population growth and economic development: Issues and evidence. In *Social Demography Series*. Madison: University of Wisconsin Press.

Jones, C. I. 1995. Time series tests of endogenous growth models. *The Quarterly Journal of Economics* 110(2): 495–525.

Kaplan, H. 1994. Evolutionary and wealth flows theories of fertility: Empirical tests and new models. *Population and Development Review* 20(4): 753–791.

Kelley, A. C. 1996. The consequences of rapid population growth on human resource development: The case of education. In *The impact of population growth on well-being in developing countries*. Edited by D. A. Ahlburg, A. C. Kelley, and K. O. Mason, 67–138. Heidelberg: Springer-Verlag.

Kelley, A. C., and R. M. Schmidt. 1996. Saving, dependency and development. *Journal of Population Economics* 9(4): 365–386.

Kelley, A. C., and R. M. Schmidt. 2001. Economic and demographic change: A synthesis of models, findings, and perspectives. In *Population matters: Demographic change, economic growth, and poverty in the developing world*. Edited by N. Birdsall, A. C. Kelley, and S. W. Sinding, 67–105. Oxford: Oxford University Press.

King, M. A., and L. Dicks-Mireaux. 1982. Asset holdings and the life cycle. *Economic Journal* 92: 247–267.

Kinsella, K. 1990. Living arrangements of the elderly and social policy: A cross-national perspective. In *US Census Bureau/CIR Staff Paper No. 52*. Washington, D. C.

Kinsella, K., and V. A. Velkoff. 2001. An aging world: 2001, international population reports. Washington, D. C.: U.S. Census Bureau.

Kotlikoff, L. J., and A. Spivak. 1981. The family as an incomplete annuities market. *Journal of Political Economy* 89(2): 372–391.

Krueger, D., and F. Kubler. 2002. Pareto improving Social Security reform when financial markets are incomplete? *National Bureau of Economic Research* (*NBER*) *Working Paper No.* w9410.

Lazear, E. P., and R. T. Michael. 1988. *Allocation of income within the household*. Chicago and London: University of Chicago Press.

Lee, R. D. 1973. Population in preindustrial England: An econometric analysis. *Quarterly Journal of Economics* 87(4): 581–607.

Lee, R. D. 1994a. The formal demography of population aging, transfers, and the economic life cycle. In *Demography of aging*. Edited by L. G. Martin and S. H. Preston, 8–49. Washington, D. C.: National Academy Press.

Lee, R. D. 1994b. Population age structure, intergenerational transfer, and wealth: A new approach, with applications to the United States. *Journal of Human Resources* 29(4): 1027–1063.

Lee, R. D. 2000. Intergenerational transfers and the economic life cycle: A cross-cultural perspective. In *Sharing the wealth: Demographic change and economic transfers between generations*, Edited by A. Mason and G. Tapinos, 17–56. Oxford: Oxford University Press.

Lee, R. D., and S. Lapkoff. 1988. Intergenerational flows of time and goods; Consequences of slowing population growth. *Journal of Political Economy* 96(3): 618–651.

Lee, R., A. Mason, and T. Miller. 2000. Life cycle saving and the demographic transition in East Asia. *Population and Development Review* 26: 194–219.

Lee, R. D., A. Mason, and T. Miller. 2001a. Saving, wealth, and population. In *Population does matter: Demography, poverty, and economic growth*. Edited by N. Birdsall, A. C. Kelley, and S. W. Sinding, 137–164. Oxford: Oxford University Press.

Lee, R. D., A. Mason, and T. Miller. 2001b. Saving, wealth, and the demographic transition in East Asia. In *Population change and economic development in East Asia: Challenges met, opportunities seized*. Edited by A. Mason, 155–184. Palo Alto, Calif.: Stanford University Press.

Lee, R., A. Mason, and T. Miller. 2003. From transfers to individual responsibility: Implications for savings and capital accumulation in Taiwan and the United States. *Scandinavian Journal of Economics* 105(3):339–357.

Lee, Y.-J., W. L. Parish, and R. J. Willis. 1994. Sons, daughters, and intergenerational support in Taiwan. *American Journal of Sociology* 99(4): 1010–1041.

Leff, N. H. 1969. Dependency rates and savings rates. *American Economic Review* 59(December): 886–895.

Leimer, D. R., and S. Lesnoy. 1982. Social Security and private saving: New time series evidence. *Journal of Political Economy* 90(3): 606–629.

Leimer, D. R., and D. H. Richardson. 1992. Social Security, uncertainty adjustments and the consumption decision. *Economica* 59(235): 311–335.

Lillard, L. A., and R. J. Willis. 1997. Motives for intergenerational transfers: Evidence from Malaysia. *Demography* 34(1): 115–134.

Lucas, R. E. 1988. On the mechanics of economic development. *Journal of Monetary Economics* 22: 3–42.

Mankiw, G., D. Romer, and D. Weil. 1992. A contribution to the empirics of economic growth. *Quarterly Journal of Economics* 107(2): 407–437.

Mason, A. 1987. National saving rates and population growth: A new model and new evidence. In *Population growth and economic development: Issues and evidence*. Edited by D. G. Johnson and R. D. Lee, 523–560. Social Demography Series, Madison: University of Wisconsin Press.

Mason, A. 1988. Saving, economic growth, and demographic change. *Population and Development Review* 14(1): 113–144.

Mason, A. 2001a. Population, capital, and labor. In *Population change and economic development in East Asia: Challenges met, opportunities seized*. Edited by A. Mason, 207–228. Palo Alto, Calif.: Stanford University Press.

Mason, A. 2001b. *Population change and economic development in East Asia: Challenges met, opportunities seized*. Palo Alto, Calif.: Stanford University Press.

McGarry, K., and R. Schoeni. 1997. Transfer behavior within the family: Results from the asset and health dynamics (AHEAD) study. *Journals of Gerontology Series B: Psychological and Social Sciences* 52B (special issue): 82–92.

Modigliani, F., and R. Brumberg. 1954. Utility analysis and the consumption function: An interpretation of cross-section data. In *Post-Keynesian economics*. Edited by K. K. Kurihara. New Brunswick, N. J.: Rutgers University Press.

Montgomery, M. R., and C. B. Lloyd. 1996. Fertility and maternal and child health. In *The impact of population growth on well-being in developing countries*. Edited by D. A. Ahlburg, A. C. Kelley, and K. O. Mason, 37–66. Heidelberg: Springer-Verlag.

Munnell, A. H. 1974. *The effect of Social Security on personal savings*. Cambridge, Mass.: Ballinger.

Okunishi, Y. 2001. Change labor forces and labor markets in Asia's miracle economies. In *Population change and economic development in East Asia: Challenges met, opportunities seized*. Edited by A. Mason, 300–331. Palo Alto, Calif.: Stanford University Press.

Poterba, J. 2000. The estate tax and after-tax investment returns. In *Does Atlas shrug? The economic consequences of taxing the rich*. Edited by J. Slemrod, 333–353. Cambridge, Mass.: Harvard University Press.

Poterba, J., and S. J. Weisbenner. 2001. The distributional burden of taxing estates and unrealized capital gains at the time of death. In *Rethinking estate and gift taxation*. Edited by W. G. Gale and J. Slemrod. Washington, D.C.: Brookings Institution.

Preston, S. H. 1984. Children and the elderly: Divergent paths for America's dependents. *Demography* 21(4): 435–457.

Razin, A., E. Sadka, and P. Swagel. 2002. The aging population and the size of the welfare state. *Journal of Political Economy* 110(4): 900–918.

Romer, D. 1990. Endogenous technological change. *Journal of Political Economy* 98: S71–S103.

Rosenzweig, M. R., and O. Stark. 1997. Handbook of population and family economics. In *Handbooks in economics*. Edited by K. J. Arrow and M. D. Intriligator Amsterdam: Elsevier.

Ruggles, S. 1994. The transformation of American family structure. *American Historical Review* 99(1): 103–128.

Samuelson, P. 1958. An exact consumption loan model of interest with or without the social contrivance of money. *Journal of Political Economy* 66: 467–482.

Singapore, A.-G.s.C. 2003. Singapore statutes online.

Solow, R. M. 1956. A contribution to the theory of economic growth. *Quarterly Journal of Economics* 70(1): 65–94.

Spengler, J. J. 1959. Economics and demography. In *The study of population: An inventory and appraisal*. Edited by P. M. Hauser and O. D. Duncan, 791–831. Chicago: The University of Chicago Press.

Takayama, N., Y. Kitamura, and H. Yoshida. 1999. Generational accounting in Japan. In *Generational accounting around the world*. Edited by A. J. Auerbach, L. J. Kotlikoff, and W. Leibfritz. Chicago: University of Chicago Press.

Tobin, J. 1967. Life cycle saving and balanced economic growth. In *Ten economic studies in the tradition of Irving Fisher*. Edited by W. Fellner, 231–256. New York: Wiley.

Toh, M. H. 2001. Savings, capital formation, and economic growth in Singapore. In *Population change and economic development in East Asia: Challenges met, opportunities seized*. Edited by A. Mason, 185–208. Palo Alto, Calif.: Stanford University Press.

United Nations. 2000. *World population prospects: The 2000 revision*. New York: United Nations.

Williamson, J. G., and M. Higgins. 2001. The accumulation and demography connection in East Asia. In *Population change and economic development in East Asia: Challenges met, opportunitites seized*. Edited by A. Mason, 123–154. Palo Alto, Calif.: Stanford University Press.

Willis, R. J. 1980. The old age security hypothesis and population growth. In *Demographic behavior: Interdisciplinary perspectives on decision-making*. Edited by T. Burch, 43–69. Boulder, Colo.: Westview Press.

Willis, R. J. 1988. Life cycles, institutions and population growth: A theory of the equilibrium interest rate in an overlapping-generations model. In *Economics of changing age distributions in developed countries*. Edited by R. D. Lee, W. B. Arthur, and G. Rodgers. Oxford: Oxford University Press.

World Health Organization, C.o.M.a.H. 2001. *Macroeconomics and health: Investing in health for economic development*. Geneva: World Health Organization.