Chapter 8
College Enrollment: An Economic Analysis

Leslie S. Stratton

Introduction

The higher education system in the USA has been the envy of the world for decades. Yet recently, graduation rates in the USA have lagged behind those in other nations, raising concerns that the USA may not be able to maintain its competitive edge in human capital investment. Degree receipt is conditional upon enrollment. The purpose of this chapter is to identify the factors that theory suggests influence the college enrollment decision and to discuss the evidence regarding how each such factor has changed over time (and may change in the future) to alter enrollment. No empirical model is estimated here. Economic theory suggests that individuals enroll in college so long as the marginal benefit associated with enrollment exceeds the marginal cost. The discussion begins with a very simple and very standard model that has only five control variables. After reviewing the role these factors play and have played, this theoretical model is expanded to allow for heterogeneity and extended to incorporate numerous other factors not always discussed in the literature. As always, no model can capture all the factors influencing enrollment, but more complex specifications are necessary to understand better the observed trends in enrollment and help those in the policy arena consider their options in addressing concerns about future competitiveness and labor market needs.

L.S. Stratton (✉)
Department of Economics, Virginia Commonwealth University,
301 W. Main Street, Richmond, VA 23284-4000, USA

Aarhus University, Aarhus, Denmark

Institute for the Study of Labor (IZA), Bonn, Germany
e-mail: lsstratt@vcu.edu

M.B. Paulsen (ed.), *Higher Education: Handbook of Theory and Research: Volume 29*,
DOI 10.1007/978-94-017-8005-6_8,

Trends in Higher Education

The USA has one of the most highly educated populations in the world. The OECD report *Education at a Glance 2011* states that the USA ranks among the top five countries in the world with 41 % of the population holding a tertiary degree. On average only 30 % of the OECD population is as highly educated. An analysis of data from the 2012 Current Population Survey (CPS) indicates that indeed 40.6 % of residents aged 25 or older have an associate's degree or more. About one-quarter of these persons hold an associate's degree, leaving 30.9 % of US residents aged 25 or older holding at least a bachelor's degree. Few countries come close to competing with the USA in this regard.

However, evidence suggests that the USA is losing ground. Statistics indicate (OECD 2011) that in most nations the percentage of the population aged 25–34 with a tertiary education is greater than the percentage of the population aged 55–64 with such a degree. In the OECD the average difference is 20 percentage points. In the USA, the fraction holding a tertiary degree differs little by age. Thus, while the USA ranks near the top in terms of the fraction of the population with tertiary education, it ranks only 15th of 34 in terms of the fraction of 25–34-year-olds with tertiary education. If the USA wishes to maintain its competitive edge, these statistics do not bode well.

Restricting the analysis to those receiving at least a bachelor's degree, the evidence looks a bit more encouraging. Figure 8.1 illustrates the fraction of 25–29-year-olds holding a bachelor's degree or more for the years 1940 through 2011. This fraction grew at an increasing rate from 1940 to 1975 and then remained level at between 22 and 23 % for about the next 20 years. Since 1994, the fraction of 25–29-year-olds completing a bachelor's degree in the USA has actually increased almost ten percentage points (or 40 %) from around 23 to 32.2 %. This recent

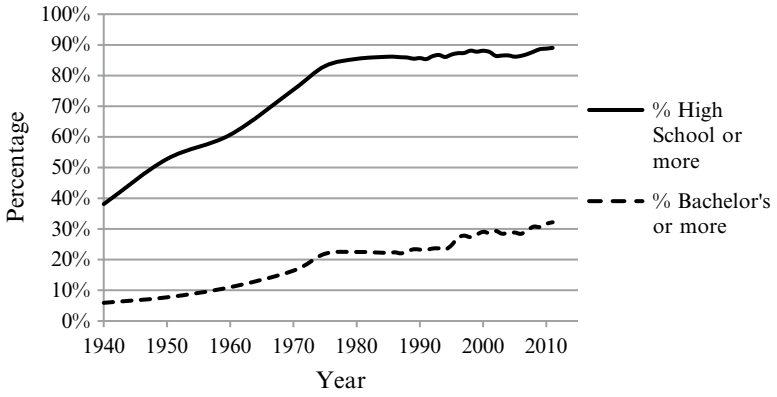

Fig. 8.1 Educational attainment in the US: Persons aged 25–29
(Source: NCES. http://nces.ed.gov/programs_008.asp. Accessed 31 August 2012.)

increase is encouraging, but the statistics indicates that there is no consistent historical pattern of increased college attainment. The evidence suggests that educational attainment moves in jumps and spurts.

Of perhaps particular concern is the small fraction of young Hispanics (age 25–29) who report having a bachelor's degree – 12.8 % versus 32.2 % for those in general population. Given that the fraction of Hispanics in the population is projected to rise from 16 % in 2010 to 20 % in 2025 and 25 % in 2040, the probability of achieving significant gains in bachelor's degree receipt during that period is unlikely. Projections from the Lumina Foundation (2013) indicate some growth in expected degree attainment by 2025, but far short of the projected needs of the labor force and the 60 % goal set by President Obama in 2010.

A concern raised by the OECD report (2011) regarding the future of tertiary education in the USA is that American students coming from upper secondary programs may not be sufficiently prepared for higher education. One generally necessary condition for attending college is completion of high school. The fraction of individuals aged 25–29 that have completed high school is illustrated in Fig. 8.1 and shows a similar pattern to that of college attainment. This fraction more than doubled from 38.1 % in 1940 to 85.4 % in 1980. While there was some growth in the 1990s, levels dipped a bit in the early 2000s before rising further to 89.0 % in 2011. High school graduation rates are certainly not soaring, but they have little room for growth as they can not in any case exceed 100 %. OECD measures indicate that the USA has the 12th highest (of 36) fraction of 25–34-year-olds completing upper secondary education, a fraction substantially higher than the OECD average. As with the OECD statistics on tertiary attainment, the USA is also the only country to report that a smaller fraction of 25–34-year-olds has completed upper secondary as compared with 55–64-year-olds. However, the USA is one of only two countries to report that over 85 % of 55–64-year-olds have a high school education. There is not much room for improvement. Indeed, the statistics illustrated in Fig. 8.1 indicate that an increasing share of high school graduates have attained a college degree. Whereas only 15 % of high school graduates held a college degree in 1950, by 1996 this figure had doubled. By 2011, fully 36 % of 25–29-year-olds with a high school degree held a bachelor's degree as well.

Test scores provide another measure of college preparedness or ability. According to the OECD report (2011), 42 % of 15-year-olds in the USA scored below a 3 on the PISA reading scale in 2009, where 3 is considered the level necessary to succeed at the tertiary level. While preparation may be a concern, however, the evidence suggests that students in the USA demonstrate knowledge similar to their counterparts in the OECD. PISA 2009 results indicated that while students in the USA did lag behind those in the OECD in math, their reading and science scores were not statistically significantly different. Results from the Progress in International Reading Literacy Study (PIRLS) indicate fourth graders in the USA perform quite well compared with fourth graders elsewhere (Mullis et al. 2012). The USA ranked seventh of 45 nations in 2011 for the percentage achieving the advanced international standard and fifth for the percentage achieving the somewhat lower high international standard. Furthermore, the evidence indicates that student performance has

improved significantly over time. Both the 2001 and 2006 results were significantly lower than those reported in 2011. Thus, differences between the OECD and the USA in terms of educational attainment for youth are not readily explained by differences in ability or preparation.

In order to increase educational attainment in the USA, more high school graduates must enroll in and complete college. While more are following this path than in the past, a still higher fraction must succeed in the future. To better understand and potentially influence college attendance and graduation rates, it is important to model the decisions high school graduates face as regards the pursuit of higher education. My goal in this chapter is to review and extend the standard human capital model of the decision to enroll in college, to discuss the factors this model predicts affect enrollment – how they have changed over time and how they differ across the population – and to explain historical and, where reasonable, project future enrollments in higher education.[1] While the concern is with bachelor's (BA) degree receipt, enrollment at both two- and four-year institutions can achieve that goal. Thus, the enrollment measures reported below capture enrollment at both types of institutions, while the outcome measures (like wages) focus on BA recipients.

The Simple Human Capital Model of the Decision to Enroll in College

The decision to enroll in college is generally modeled by economists using human capital theory (Becker 1975; Mincer 1974; Paulsen and Toutkoushian 2008 provide an overview). A standard and very simple version of this model, one presented in many textbooks, is as follows:

$$\sum_{t=0}^{T} \frac{W_{\mathrm{H}}}{(1+r)^t} \; vs \sum_{t=0}^{3} \frac{-C}{(1+r)^t} + \sum_{t=4}^{T} \frac{W_{\mathrm{C}}}{(1+r)^t}$$

where T represents the employment horizon or years till retirement, r an annual discount or interest rate, C the direct annual cost of college, W_{H} the fixed annual earnings of a high school graduate, and W_{C} the fixed annual earnings of a college graduate. The first expression above represents the net present value associated with a high school degree. The second expression identifies the net present value associated with a college degree. The first term in the second expression reflects the costs associated with attending college, and the second term reflects the benefits. As these costs and benefits are spread over many years, it is important to recognize the time value of money,

[1] The discussion here is limited to enrollment. As stated in the introduction, enrollment is a necessary condition for graduation. To meet future needs, however, students must not only enroll but also graduate. Further work examining progress to a degree is essential, but beyond the scope of this text.

hence the use of a discount rate *r*. Ideally the wage and cost measures are adjusted for inflation so that inflation does not play a role, but a dollar today is still preferred to a dollar equivalent (i.e., adjusted for inflation) received 1 year from today. A dollar received today can after all be enjoyed or invested today. Alternatively, a dollar received today could have been borrowed, in which case *r* can be thought of as the interest rate on that loan. Overall, *r* is a critical if often neglected element in the equation above. According to theory, an individual for whom the first expression is greater in value than the second will choose not to attend college, while an individual for whom the second expression is greater in value than the first will attend college.

An important contribution of this model is its presentation of the decision to attend college as an investment decision. Individuals who go to college incur direct costs and forego the immediate earnings they could receive with a high school diploma, in pursuit of the higher future earnings college graduates receive. The expression is often rewritten as follows to highlight this perspective:

$$Costs = \sum_{t=0}^{3} \frac{C + W_{\mathrm{H}}}{(1+r)^t} \; vs \; \sum_{t=4}^{T} \frac{W_{\mathrm{C}} - W_{\mathrm{H}}}{(1+r)^t} = Benefits$$

The costs associated with attending college constitute the present value of the direct costs (*C*) as well as the indirect or opportunity costs of the earnings foregone during attendance (W_{H}). The benefits associated with attending college constitute the present value of the wage differential between college and high school graduates.

From this model, it is clear that college attendance is more likely the greater are *T* and W_{C} and the lower are W_{H}, *C*, and *r*. The greater *T* is (all else constant), the longer is the time period over which college educated individuals can reap the benefits of their higher earnings. The greater W_{C} is, the greater is the earnings differential associated with a college degree. The greater W_{H} is, the greater is the opportunity cost associated with obtaining a college degree and the smaller is the subsequent benefit. The greater *C* is, the greater are the costs associated with obtaining a college degree. Finally comes *r*. Interpreted as a discount rate, the greater *r* is, the more the individual values money now over money in the future. The greater *r* is, the more costly is the immediate investment and the less valuable the future reward. Interpreted as an interest rate, the greater *r* is, the more expensive the loan will be and the less likely the investment in higher education will be worthwhile.

Changes in these factors within the population over time will change optimal educational attainment over time. In the text that immediately follows, each factor is considered in turn. Historical trends and their likely contribution to enrollment trends are reviewed. Where appropriate, projected future changes are also discussed. Throughout this section, the focus is on this simple model as it applies to a population of homogeneous individuals. The next section considers how these factors differ across the population, for example, by gender, race, and geographic location. The final section extends the model by relaxing many of its underlying assumptions. For example, this specification assumes that everyone takes exactly 4 years to complete their bachelor's degree, does not work while in college but works full time every other year, etc.

T*: The Employment Horizon*

T has changed over the last 50 years in several distinct ways. First, people are living longer. Second, the average workweek has shrunk. Third, retirement policy (both that of the government and of firms) has changed. These factors influence the length and intensity of employment and thereby optimal education levels.

Life expectancy at age 0 has increased from around 50 years in the first decade of the 1900s to 60 in 1937, 70 in 1960, and 75 in 1989. While the rate of increase is slowing, projections suggest life expectancy at age 0 in 2010 was 78.3 (Bureau of the Census 2012, Table 104). If a longer life horizon translates to a longer work horizon, individuals should optimally invest in more education. Indeed, Restuccia and Vandenbroucke (2013) estimate that 20 % of the increase in average educational attainment between the mid-1800s and the mid-1900s was attributable to rising life expectancy. However, increased educational attainment may also improve health and increase life expectancy (see, e.g., Ross et al. 2012). The result is an endogenous relation as not only do increases in *T* lead to increases in education, but increases in education lead to increases in *T*. Furthermore, on a more basic level, it is not longevity of life per se, but length and intensity of time in employment that acts to increase the benefits associated with higher education.

Intensity of work, as measured by hours worked per week, has declined substantially over the last century. Wolman (1938) reports that the average full-time workweek for factory workers declined from 55.1 to 51.0 h during World War I and declined again between 1933 and 1935 from approximately 50 to approximately 42 h. He reasons that the shortage of labor during World War I gave labor the opportunity to negotiate not only better wages but also better working conditions, a conclusion supported by Restuccia and Vandenbroucke (2013). The decline during the 1930s was likely attributable to decreased labor demand as well as the Fair Labor Standards Act of 1938 which imposed a 40-h workweek on about 20 % of the US industry. There has been little change in full-time hours since. The average hours worked per week by persons working full time in the nonagricultural sector in 2012 were 42.4. On the other hand, part-time employment has become substantially more common. In 1955, 10 % of the labor force reported working part time; by 2012 this fraction had increased to 19 %. Decreasing work hours in general reduces the incentive to invest in education. However, again endogeneity is an issue as at least some of the decrease in work hours was driven by more educated workers "purchasing" a shorter workweek with their higher labor income.

While the change in the average intensity of work has generally been in the same direction over time, the same cannot always be said of the average age of retirement. Munnell (2011) documents a decline in men's average retirement age beginning in 1880 that is attributed to fairly generous Civil War veterans' old-age pensions. Inexplicably, retirement age did not rise for the generation that followed (Munnell 2011). Retirement age then began to decline again around World War II. A key driver at this time was the Social Security Act of 1935. Prior to implementation, individuals had to be self-supporting or to rely on family and friends in order to stop

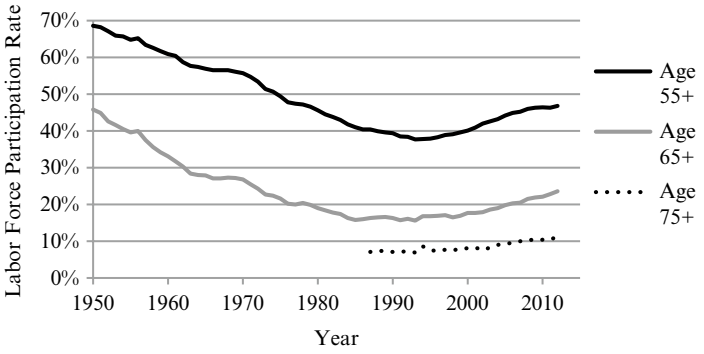

Fig. 8.2 Labor force participation rates of older men
(Source: Bureau of Labor Statistics, Series LNU01324231, LNU01300199, and LNU01315346.)

working. Under this act, taxes are collected from workers and distributed to retired workers aged 65 or over. These distributions began in 1940 and have without a doubt altered the labor force participation rate of the elderly.

All persons who are employed or actively looking for work are classified as "in the labor force." The labor force participation rate is calculated as the number of persons in the labor force divided by the number in the population. Figure 8.2 illustrates the labor force participation rate for older men, providing data for those aged 55 and over and aged 65 and over for the years 1950 to 2012 and for men aged 75 and over for the years 1988 to 2012.[2] Clearly the labor force participation rate for older men is lower than it is for younger men. While almost 70 % of men aged 55 and over were in the labor force in 1950, the same is true for only about 45 % of those aged 65 and over. There has always been a differential by age as older persons are more likely to be incapacitated by disability, but the availability of social security increased the differential considerably. By comparison, 65.1 % of men aged 65 and over were in the labor force in 1900 (Bureau of the Census 1975). Had they anticipated this legislation, men born after 1875 (turning 65 after 1940) would have an incentive to invest in less education, even as their life expectancy increased. Those born after 1930 would certainly have had this incentive.

Figure 8.2 shows that the labor force participation rate of older men declined further between 1950 and 1990, from almost 70 % to below 40 %. This pattern is similar for those aged 65 and over, whose labor force participation rate declined from about 45 % in 1950 to below 16 % in the early 1990s. Changes in the Social Security program may explain some part of this decline. Early benefits (at age 62) became available to men in 1961. Benefits themselves became more generous, particularly between 1965 and 1975. Blau and Goodstein (2010), however, estimate

[2] The employment rate (the number employed divided by the number in the population) could also be used to illustrate the impact of the Social Security Act, but this number shows far more variability over the course of business cycles.

that changes in social security account for less than 20 % of the reduction in older men's labor force participation rate, with perhaps 8 % more explained by changes in the Social Security Disability Insurance program. Other explanations include the availability of retiree health insurance (Blau and Gilleskie 2008) and the greater availability and increased generosity (particularly for early retirees) of employer-provided defined benefit plans (Bell and Marclay 1987). Rising real wages also played a role. Higher earnings increase demand for all normal goods, including leisure. Though average hours worked per week appear to have reached a plateau, early retirement is another way to achieve increased leisure time. The entry of the baby boomers into the labor market in the 1970s and 1980s may also have pushed some older workers into retirement (Macunovich 2012). Any trend toward earlier retirement would favor decreased educational attainment.

Since 1990, however, this trend has been reversed. Labor force participation rates have climbed almost ten percentage points (from 38 to almost 47 %) for men aged 55 and over, 7.5 percentage points (from 16 % to over 23 %) for men aged 65 and over, and almost 4 percentage points (from a low of 6.9 % to over 11 %) for men aged 75 and over. Part of the impetus for this change comes from legislative mandates that make employment more attractive to older persons. Legislation passed in 1983 increased the age at which full retirement benefits can be received from 65 to 67. The earnings exemption (the amount those receiving social security payments are allowed to receive in earnings before incurring a dollar for dollar reduction in their benefits) began increasing in 1996 and was eliminated for those of full retirement age in 2000. Research suggests such mandates have a significant impact (Behaghel and Blau 2012; Manchester and Song 2011; Blau and Goodstein 2010; Mastrobuoni 2009; see Staubli and Zweimueller 2011 for further evidence from Europe). Friedberg and Webb (2005) suggest that the movement towards defined contribution and away from defined benefit retirement plans has also been important, reporting that those facing a defined contribution plan retire about 2 years later than those with defined benefit plans. Stagnant or declining real wages over this time period and smaller youth cohorts may also have played a role. Increases in the retirement age will act, all else equal, to increase demand for higher education, and these increases appear less tied to educational choice than the aforementioned changes in the employment horizon.

While changes in T theoretically impact enrollment in higher education, their actual effect is likely to have been and continue to be small. Life expectancy increased but work hours fell and older individuals now have more resources with which to retire. The benefits associated with a longer employment horizon (people *are* now more likely to live into their 50s) occur so far into the future that in present value they are heavily discounted and so have little impact, even less after accounting for the more near-term decrease in workweeks. In addition, these historical changes likely had a greater impact on secondary than on postsecondary enrollment. Future changes in life expectancy (which already exceeds the legislated retirement age) and work intensity are unlikely to affect a change in enrollment. The factor most likely to do so is retirement age. Though no changes to social security are currently imminent, it is likely that the age at which individuals are eligible to receive

full benefits will rise in the future in order to ensure solvency of the program. Such a change will induce enrollment by only a few individuals and do little to help the USA maintain its competitive edge in higher education.

$W_C - W_H$: *The College Wage Premium*

The next key determinant of college enrollment is the college wage premium, or the difference between the wage of a college graduate and the wage of a high school graduate. This premium drives the benefits side of the enrollment decision. Increases in the earnings of college graduates and decreases in the earnings of high school graduates increase the premium and act to increase enrollment. It is only via their impact on the premium that the earnings of college graduates influence enrollment. The earnings of high school graduates also alter the opportunity cost of attending college – an effect discussed in the next subsection.

There is substantial evidence that wages and the college wage premium have changed over time. Goldin and Katz (2007b) document the college wage differential (the difference between the earnings of individuals with a college degree as compared to a high school diploma) from 1915 to 2005. They estimate that the differential exceeded 60 % in 1920 and fell to 50 % around 1940 and almost 30 % in 1950. The premium then rose to about 45 % in 1970 before dipping below 40 % in 1980 and rising further to 60 % in 2005. On net, they find that the college wage differential is roughly the same today as it was in 1915. Autor et al. (2008) estimate composition-adjusted education wage premiums for 1963 through 2005. These premiums are calculated for full-time, full-year workers only and are adjusted for gender, potential experience (age), region, and race. They also allow education to have a different effect by experience. Like Goldin and Katz, they find an increasing premium through around 1970, followed by a decrease through about 1981, and an increase thereafter. The increase is particularly notable in the second half of the 1990s when the economy was booming. Also notable from Autor et al. (2008) is the evidence of a rising premium for postgraduate education. Indeed, these authors argue that while the earnings gap between those with a college degree and those with a high school degree increased by 13.5 log points (approximately 13.5 %) between 1988 and 2005, the earnings gap between those with a postgraduate degree and those with a college degree increased by 14.2 log points. This is in contrast to an increase of 13.3 and 2.1 log points, respectively, between 1979 and 1988. Autor et al. (2008) also report that while the composition-adjusted earnings gap between high school graduates and high school dropouts increased steadily between 1979 and 1997, it has since flattened or even decreased.

These are but a couple articles from a large and growing literature in economics addressing rising income inequality in the USA. The goal of these articles is to explain changes in wage inequality, typically using standard economic theories of supply and demand. Goldin and Katz (2007b), for example, characterize the period 1915–1980 as one during which the supply of educated persons exceeded the

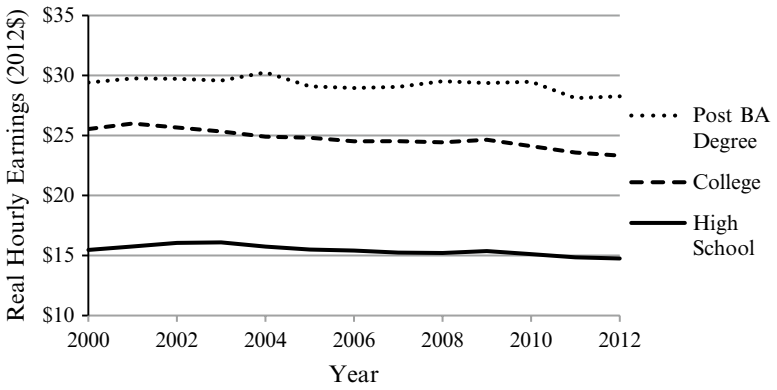

Fig. 8.3 Average hourly earnings by completed education
(Source: Numbers generated by author from CPS Outgoing Rotation Groups. Sample restricted to persons aged 25–34.)

demand for such persons. As a result, the wage premium associated with education generally decreased. They argue that the opposite was true for the period 1980–2005, during which the wage premium increased. This literature (see, e.g., Autor et al. 2008) also covers the role of wage-setting interventions during World War II, the minimum wage, and unionization patterns in driving educational wage premiums. The goal of this chapter, however, is not to explain wage differences by education level but to document them and their likely impact on investment in higher education.

The evidence presented to date documents changes in the premium up to the year 2005. Figure 8.3 presents information on the average real hourly earnings of individuals with only a high school degree, only a baccalaureate degree, and, in recognition of Autor et al.'s (2008) findings regarding the post-baccalaureate premium, individuals with a postgraduate degree for the years 2000 through 2012. These data come from the CPS and are restricted to include only persons between the ages of 25 and 34.[3] They clearly illustrate the substantial earnings difference between individuals with a high school degree (whose earnings hover around $15 per hour) and those with further degrees. College graduates earn about $10 more per hour than high school graduates. Individuals with a post-baccalaureate degree earn about $15 more per hour. Also apparent in the data is a slow decline in the real earnings for all these populations. On average, college graduates experienced a decrease from about $25.50 to about $23.50 per hour, a decline that appears to accelerate somewhat in the aftermath of both the 2001 and the 2007 recessions. The real earnings of those with a post-baccalaureate degree remained quite stable till 2010 but have fallen since 2010 by almost $1. It is of some interest to note that on average wages have fallen more for more educated individuals than for high school

[3] Individuals who are in the military or enrolled in college full time are also excluded.

graduates, causing the college wage premium to decline slightly from around 60 % in 2005 (the same differential reported in Goldin and Katz 2007a) to about 58 % in 2012. Nevertheless, the premium remains substantial.

The discussion here has focused on the earnings differential between college graduates and high school graduates. This chapter, however, is about college enrollment not necessarily completion. Many who enroll in college do not complete. Evidence abounds that additional years of education (and hence enrollment) increase earnings even in the absence of an earned degree. Evidence also points to what is popularly called a sheepskin effect such that earnings rise more in the year a degree is received than in any other year of enrollment (see, e.g., Jaeger and Page 1996). Flores-Lagunes and Light (2010) actually find that earnings rise with time enrolled for those who do not complete a degree but fall with time enrolled for those receiving a degree, the explanation being that more time in a program increases one's skill, but less able individuals take longer to complete. Greater skill increases productivity on the job and hence earnings, but lesser ability does the opposite. In any case, there is ample evidence that earnings are higher for those with more education.

In general, rising college wage premiums between 1980 and 2005 increased the benefits associated with attending college. Stagnant premiums since have maintained these higher benefits without increasing further the incentive to attend college. Falling premiums have the potential to decrease the incentive to attend college. As the earnings differential between high school and college graduates is substantial and the demand for more educated workers still rising faster than overall demand (per projections from the Department of Labor), the incentive to enroll in college should remain strong.

W_H: *Opportunity Cost*

An important consideration, however, is the cost associated with that college degree. The most important cost component for most students is the foregone earnings associated with enrollment. Recall that the simple human capital model assumes that individuals enroll in college full time and are not simultaneously employed. This assumption will be relaxed later. In practice, this assumption means that the opportunity cost associated with attending college will be closely related to the average real earnings of high school graduates aged 18–24. Figure 8.4 shows these averages for the period 2000 through 2012.

Though the earnings premium associated with a college degree remained relatively stable between 2000 and 2012, the real hourly earnings of young high school graduates declined by $1.28 or 10.6 %. The decline was somewhat greater for women (12 %) than for men (10 %). In general, these figures suggest that the opportunity cost associated with attending college has decreased in the past decade, a factor that should support increased college enrollment.

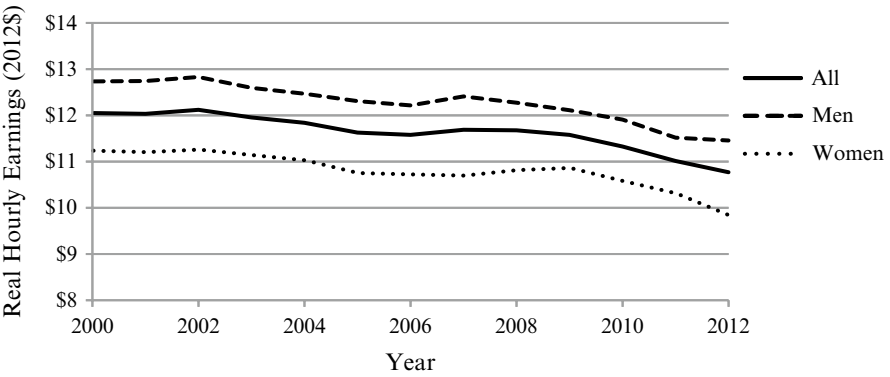

Fig. 8.4 Average hourly earnings of high school graduates, age 18–24
(Source: Numbers generated by author from CPS Outgoing Rotation Groups for persons age 18–24 not enrolled full-time in college.)

C*: Direct Costs*

The other cost associated with attending college is the direct cost designated *C* in the model above. This cost covers all costs that the individual would not have incurred if he/she had not chosen to go to college. Tuition is a major factor here, but any costs for books, lodging, food, and transportation to school that would not otherwise be incurred should also be included. Often the simple model is presented with the assumption that college students are able to earn enough money from jobs during the summer and breaks in order to cover most miscellaneous expenditures. As food and housing are necessary even if an individual were not enrolled, these costs are not typically incorporated into *C*. The text below focuses first on tuition then on the net cost as adjusted by grant aid. Students are assumed to be able to borrow to cover these costs at an interest rate discussed in the following subsection. The role of family income and family support more generally is discussed later in the chapter.

The National Center for Education Statistics (2012, Chapter 3) reports average total tuition and required fees charged for full-time students at four-year institutions using in-state rates for the academic years 1980–1981 through 2010–2011. These figures have received substantial attention in the press (an exception being Pérez-Peña 2012 who acknowledges the net cost measures). According to these figures, real or inflation adjusted charges increased on average 4.2 % annually during the 1980s, 3.1 % annually during the 1990s, and 3.2 % during the first decade of this century. The College Board (2012) reports rates separately by type of institution. They show annual real rates rising by an average of 4.6 % at both public and private four-year institutions between 1982–1983 and 1992–1993. Charges then rose less rapidly between 1992–1993 and 2002–2003 – 3.0 % at private institutions and 3.2 % at public institutions – and diverged from 2002–2003 to 2012–2013 by rising

still more slowly at private institutions (2.4 % per year) and increasing at public institutions as they faced increasing budget constraints (5.2 % per year). These substantial cost increases should have a substantial impact on college enrollment given that these costs are incurred in the near term and hence virtually undiscounted by *r*.

However, gross charges do not tell the full story. Relatively few students pay these list prices. The College Board (2012) also publishes estimates of net tuition and fees. These figures tell a surprisingly different story. While list price for private four-year colleges rose from $17,040 in 1992–1993 to $29,060 in 2012–2013, net price for students attending these colleges rose only from $10,010 to $13,380. Where gross price rose 70 % or $12,020 over the course of these 20 years, net price rose only 34 % or $3,370. The story for public four-year colleges is similar. List price rose on average from $3,810 to $8,660 (an increase of 127 % or $4,850), while net price rose from $1,920 to $2,910 (an increase of 52 % or $990). Rising costs will reduce the incentive to enroll in college, but the costs are not rising as rapidly as the measure of tuition alone suggests.

These figures indicate that net price constituted 50–59 % of gross price in 1992–1993 but only 34–46 % in 2012–2013. There are several explanations for the increased divergence between the gross and net price of college attendance. First, there have been changes in the Federal Pell Grant Program. Pell grants could cover about 16 % of the listed cost of the average private college and 40 % of the listed cost of the average public college in 1992–1993. These grants have not become more generous (covering only 15 and 34 % of tuition today) but have become more numerous. The number of grants awarded rose 31 % between 2008 and 2009 and another 15 % between 2009 and 2010. Second, the Post-9/11 GI Bill offered significantly increased educational benefits for veterans and in some cases their dependent children.[4] These expenditures have ballooned the education and vocational rehabilitation budget of the Veterans Administration from $2.2 billion (2012$) in 2000 to $10.4 billion in 2012. Overall, the fraction of enrolled students receiving federal grant aid has increased by 50 % between 2000 and 2010 (from 31.6 to 47.8 %), and the average grant has become more generous ($3,232 to 4,894 in $2011/12). The availability of the American Opportunity Tax Credit beginning in 2009 has the potential to be a significant factor as well. The first $2000 expended on tuition is returned at tax time, as well as 25 % of the next $2000. Federal policy has significantly reduced the burden of costs, but the fraction of students taking out loans has increased over the last ten years (from 40 % to 50 %) and the balance on these loans has increased (from $4,900 to $6,800 in $2011/12) (National Center for Education Statistics 2012, Table 387).

Research regarding the impact of tuition charges and financial aid on enrollment provides clear evidence of the importance of these factors, particularly for lower-income households. McPherson and Schapiro (1991) find that a reduction in the net cost of college significantly increases enrollment for low-income whites. St. John (1990) reports that aid of any sort (including loans) increases enrollment particularly

[4] The post-World War II GI Bill also offered significant aid to veterans enrolling in college, and there is evidence (Bound and Turner 2002) that this bill substantially increased veterans' educational attainment.

for low-income students. He further reports that a $100 increase in aid has a larger impact than a $100 reduction in tuition charges. Kane (1994) also reports that aid has a larger effect on enrollment than tuition. He posits that list prices may scare off students who would be eligible for aid before they understand that such aid is available. Thus, there is evidence that it is important to distinguish between list price and aid when modeling enrollment trends; net price alone may not be a sufficient statistic. Indeed, research by Bettinger et al. (2012) suggests that just filling out the FAFSA form deters a substantial fraction of low-income individuals who are likely eligible for federal assistance. In a randomized experiment, they find an 8 percentage point increase in enrollment (from 28 to 36 %) for students from low-income households that randomly received help filling out the FAFSA forms as well as information about financial aid versus those who did not. There was no significant difference in enrollment between those who only received information about financial aid and the control group.

Analysis of the impact aid has on enrollment is also complicated by the fact that aid is not distributed randomly. Need-based aid is offered disproportionately to individuals with less income who may for other reasons be less likely to attend college. For example, such persons may be less well prepared for college because of the schools they have been attending and less knowledgeable about college because there is little family experience. In this case, the impact of aid on enrollment may be underestimated in standard models of aggregate enrollment trends. Conversely if aid is merit based, it may be directed to individuals who were already likely to attend college, and so its effect would be overstated in standard models. Several researchers have used quasi-experimental approaches to try to avoid this bias. Dynarski (2003) does so by looking at the impact the elimination of the Social Security student benefit program had on college enrollment. She uses a difference-in-differences methodology that essentially compares the enrollment of students whose fathers have died with the enrollment of students whose fathers have not died, after versus before the change in the benefit program. Parental death is exogenously determined and likely to affect enrollment in all periods. The key is identifying how the effect of a deceased father changed with the policy change. She finds that a $1,000 reduction in aid reduced college enrollment by 3.6 %. Similar results are reported using difference-in-differences techniques to compare college enrollment for 18–19-year-old residents of Georgia (versus other southeastern states) before and after the introduction of the HOPE scholarship (Dynarski 2002). In this case, $1,000 in aid increases college enrollment by 4–6 %. Lovenheim and Owens (2013) exploit a policy change that introduced a temporary 2-year ban on federal aid for individuals convicted of a drug offense, finding that drug offenders completing high school during the period this ban was in effect were significantly less likely than drug offenders in other periods were to enroll in college within 2 years of completing high school, all as compared to the enrollment rate of non-offenders.

Rising tuition costs clearly put a damper on enrollment; financial aid certainly acts to encourage enrollment. Overall, costs have been rising more rapidly than aid. Federal policy has been quite generous in the last decade, but state funding for higher education has not kept pace (National Center for Education Statistics 2012,

Tables 387 and 401). If this trend continues, and given continued concerns about federal and state budgets it is likely to continue, enrollment rates will likely decline not increase.

r: *The Discount/Interest Rate*

The final factor in the basic model of the decision to attend college is *r*. As stated earlier, higher discount rates indicate a greater preference for money today rather than money tomorrow and/or a higher interest rate on student loans and will be associated with less investment in higher education. Higher discount rates are also indicative of higher risk. Uncertainty about the future will cause individuals to prefer consumption today to consumption tomorrow and will cause lending institutions to require higher interest rates.

Looking at rates of time preference, there is some evidence that individuals have higher discount rates during recessions than during periods of economic growth (DePaoli and Zabczyk 2012). These results have been replicated in an experimental study by Guiso et al. (2011). However, there is no evidence of systematic trends in time preference that might explain or predict changes in enrollment rates.

Interest rate analysis is more complicated. Funds for higher education may come from the government in the form of student loans or from parents/relatives. Table 8.1 presents information on nominal and real interest rate charges for first year unsubsidized Stafford loans. Nominal rates have varied from a high of 8.25 % (the maximum allowable) in 1995–1998 to a low of 3.37 % in 2004–2005. They have been fixed at 6.8 % since 2006. Real rates have shown even more variation, ranging from 8.3 % in 2008–2009 when falling gasoline prices caused a negative inflation rate to −0.3 % in 2004–2005 when inflation rates exceeded expectations. Further complicating such analysis, there are limits as to how much can be borrowed under this program and a variety of other public and private financing options available. In general, no clear pattern emerges that could explain or predict changes in college enrollment over time.

Review of the Simple Human Capital Model

As documented here, the simple human capital model provides a framework for analyzing the decision to enroll in college that depends on only five factors. There have been significant changes in some of these factors over the last century that help explain some of the time pattern of educational attainment. For example, increased longevity and substantial education wage premiums likely increased educational attainment at the secondary level in the early half of the 1900s. Figure 8.5 illustrates the fraction of recent male high school graduates enrolled in college between 1960 and 2012. This percentage has varied substantially from a low of 46.7 % in 1980 to

Table 8.1 Interest rates on unsubsidized Stafford loans

Academic year	Nominal rate (%)	Real rate (%)
2010–2011	6.80	3.03
2009–2010	6.80	5.65
2008–2009	6.80	8.28
2007–2008	6.80	1.43
2006–2007	6.80	4.83
2005–2006	5.30	1.48
2004–2005	3.37	–0.27
2003–2004	3.42	0.77
2002–2003	4.06	1.90
2001–2002	5.99	4.19
2000–2001	8.19	5.47
1999–2000	6.92	3.51
1998–1999	7.46	5.20
1997–1998	8.25	6.63
1996–1997	8.25	6.02
1995–1996	8.25	5.37
1994–1995	7.43	4.81
1993–1994	6.22	3.32
1992–1993	6.94	4.17

Loans obtained before 2006–2007 have a variable interest rate. Those obtained later have a fixed interest rate. Only first year rates are shown for the variable interest rate loans
Real rates are calculated by subtracting the inflation rate as calculated from the Consumer Price Index for All Urban Consumers using August to August measures

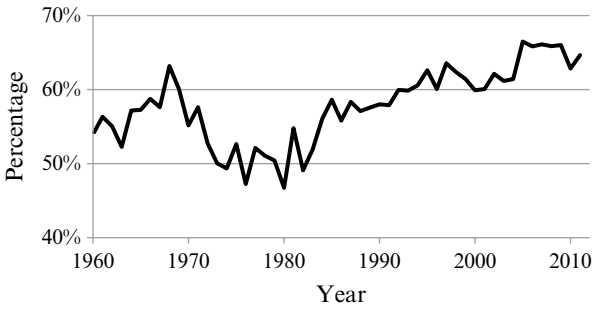

Fig. 8.5 Fraction of young men enrolled in college
(Source: *Digest of Education Statistics*, 2012. Table 209. Calculated as a fraction of persons age 16–24 who completed a high school degree or GED within the previous 12 months enrolled in 2 or 4 year colleges.)

a high of 66.5 % in 2005. The fraction rose through the 1960s, fell substantially in the 1970s, rose fairly rapidly in the early 1980s, and has generally been rising slowly since. Overall there has been a modest upward trend of 0.2 % per year. The rising college wage premium between 1950 and 1970 and 1980 and 2005 likely helped

spur the increases in the 1960s and post-1980. Lower opportunity costs also played a role, while rising direct costs tempered these effects. Changes in retirement policies because they are both difficult to predict ex ante and occur so far in the future likely have had little impact. Nor is it likely that changes in discount/interest rates can explain the broad trend. The simple model is by construction simple. There are many more factors influencing enrollment worth exploring.

Recognizing Heterogeneity

If the simple model were an accurate representation of the college enrollment decision and every individual faced the same values of *T*, *C*, *W*, and *r*, every individual would make the same choice. Clearly such is not the case. For the decision to differ within the population, these factors must take on different values within the population. In this section, I examine the role of heterogeneity within the population, particularly by basic demographic and geographic characteristics.

I begin by documenting the substantial heterogeneity observed in college enrollment both in 2011 and where possible historically. Figure 8.6 illustrates the fraction of recent high school graduates enrolled in college from 1960 through 2011 separately by gender. While as discussed above enrollment during this period has grown slowly at an average of 0.2 % per year for men, enrollment has increased three times more rapidly (more than 0.6 % per year) for women. Whereas women were 30 % less likely to be enrolled than men in 1960, they are currently about 10 % more likely to be enrolled than men.

Figure 8.7 illustrates the fraction enrolled in college by race/ethnicity from 1975 through 2011. Enrollment in 1975 was actually fairly similar for all groups, ranging from a low of 45 % for African Americans to a high of 53 % for Hispanics. The rates

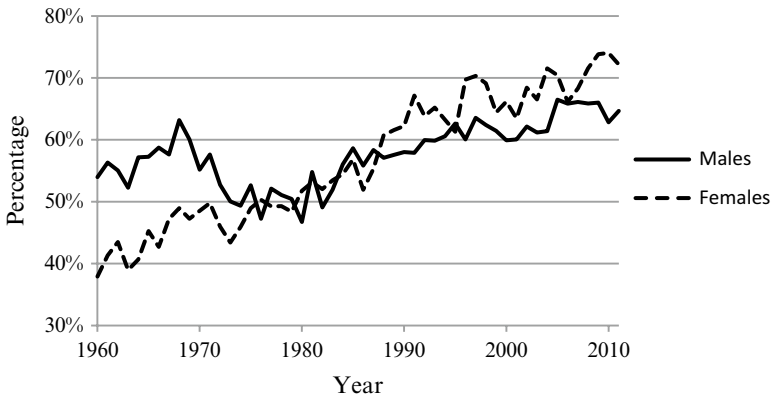

Fig. 8.6 Fraction enrolled in college by gender
(Source: *Digest of Education Statistics*, 2012. Table 234. Calculated as a fraction of persons age 16–24 who completed a high school degree or GED within the previous 12 months enrolled in 2 or 4 year colleges.)

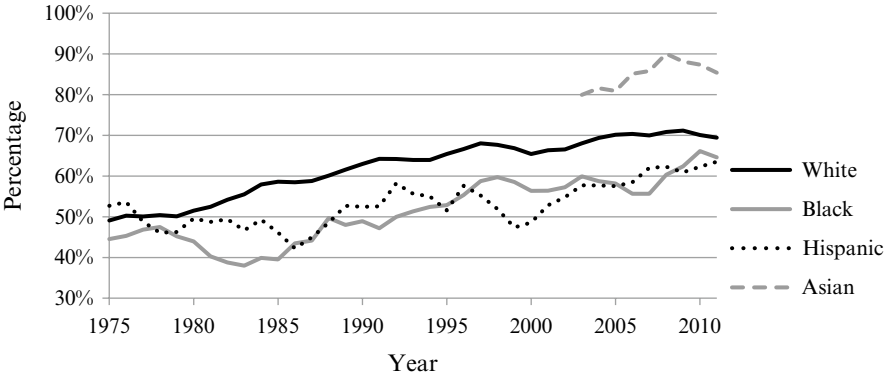

Fig. 8.7 Fraction enrolled in college by race/ethnicity
(Source: *Digest of Education Statistics*, 2012. Table 235. Persons age 16–24 who completed high school degree or GED within previous 12 months.)

diverged through the mid-1980s. Enrollment rose for whites, fell for African Americans, and stagnated for Hispanics. Enrollment rates picked up for all groups in the late 1980s, but the rate for whites has remained significantly higher than for either Hispanics or African Americans. Over the entire period, enrollment actually increased at a comparable rate for African Americans and whites and at a somewhat lower rate for Hispanics. Information on those of Asian descent is available only beginning in 2003 and indicates very high and generally rising rates of college enrollment. It is important to note here that these raw differentials likely capture much more than simply race/ethnicity – differences in family background and income and differences in academic preparation that are correlated with race – and as such may be quite misleading. The next section of the paper extends the model to consider these other factors, and so the discussion of racial/ethnic differences will be continued there. The discussion here simply seeks to determine how much if any of these raw differences might be explained by the simple model.

Heterogeneity in enrollment by gender, race/ethnicity, and other dimensions can be accommodated in the simple human capital model only if T, W_C, W_H, C, or r differs across these dimensions. The standard approach in the education literature has been to include controls for demographic characteristics when analyzing college enrollment, but this practice fails to explain the differences. Preferences will play a role, particularly when the model is expanded to recognize the utility or consumption value associated with a higher education, but it is important that researchers not rely too heavily on preferences to explain demographic differences in enrollment. Preferences, after all, are notoriously difficult to measure and to predict. Relying on differences in preferences to explain differences in outcomes also poses problems for predictions as preferences can change. A discussion of how the arguments in the human capital model differ by demographic characteristics and how these differences can explain enrollment patterns follows, beginning with a focus on gender.

Gender

There exist gender differences along many dimensions that have the potential to explain gender differences in enrollment. Differences in T, the college wage premium, high school earnings, direct costs, and r will be discussed in turn. Differences in T hinge on differences in longevity, labor market experience, and retirement.

Women have a greater expected lifetime as compared to men – 80 versus 75 years. The differential has existed for as long as statistics have been collected but has been shrinking since 1975. Theory would predict women would obtain more education than men with the difference shrinking for more recent cohorts. In fact the opposite is true. As discussed earlier, however, this difference adds value only far in the future and occurs after the age individuals are eligible to receive social security benefits – which does not vary by gender. The age at which individuals report retiring does differ by gender, with women tending to retire at an earlier age than men, but the difference as reported by the OECD was only 0.4 years in 2011. Gender differences in work life length do little to explain gender differences in enrollment.

Gender differences in the intensity of work are, however, likely an important factor. The standard human capital model of the decision to invest in college assumes that the only reason for doing so is to increase one's lifetime earnings. Goldin (1986) reports that the labor force participation rate of women was 18.9 % in 1890 and rose only to 24.8 % in 1930. Most of this participation was by women who worked prior to getting married. Given women's primary role in the home for much of the nineteenth and early twentieth centuries, the simple human capital model would suggest that women would optimally obtain very little education. Yet Goldin et al. (2006) report that the ratio of men to women attending college was close to one for the years 1900–1930, "if one counts two-year teaching programs" and stable at 1.5 to 1 if one does not. Men then increased their enrollment relative to women up to a peak in 1947. Since 1947, women have increased their enrollment more rapidly than men.

To explain women's enrollment in higher education in the early 1900s requires some modification of the simple model of college enrollment presented above. For example, one could argue that more education makes women more productive not only in the labor market but also in the home – more effective housekeepers and mothers. In addition, attending school may have been a way of meeting better providers. It is well known that a substantial degree of assortative mating goes on in the marriage market (Mare 1991). More educated men tend to marry more educated women, and this trend has been increasing over time (Greenwood et al. 2012). Thus, women may pursue higher education in order to increase their chances of meeting and marrying a more educated man who could, because of his higher productivity in the labor market, better provide for her material needs. Such modifications to the standard model help explain why some women did pursue higher education even if they did not intend to have a career in the early 1900s.

It is, however, women's changing economic and social roles over the past century that likely explains their higher education enrollment gains relative to men. Prime-aged women (those aged 25–54) have increased their labor force participation rate

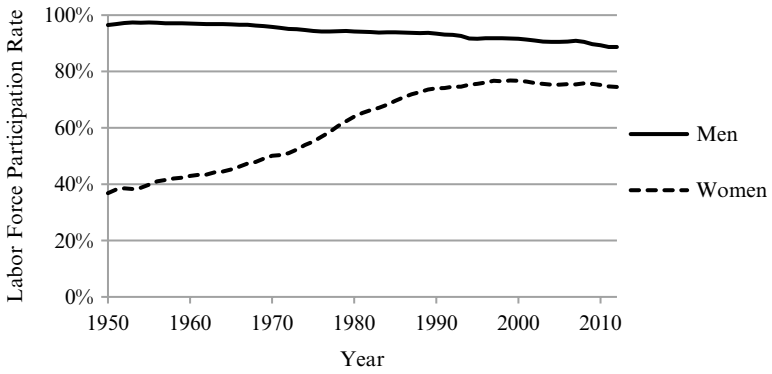

Fig. 8.8 Labor force participation rate. Persons age 25–54
(Source: Bureau of Labor Statistics, Series LNU01300061 and LNU01300062.)

dramatically as compared to prime-aged men. Figure 8.8 illustrates the labor force participation rate by gender for prime-aged persons between 1950 and 2012. Men's participation has fallen from over 97 % for most of the 1950s to 88.7 % in 2012. To the extent that the labor force participation rate serves as a proxy for T, men should be somewhat less inclined now to enroll in college, all else equal, than they were in 1950. Women, on the other hand, have become much more attached to the labor market. Only 36.8 % of women between the ages of 25 and 54 were in the labor market in 1950. This fraction rose to 50 % in 1970 and 75 % in 1995.

Hours worked per week also differ by gender. Women have always been more likely to be employed part time, but the difference is narrowing. While on average women worked 7.6 h less than men in 1976, by 2010 this differential had declined by one-third to 5.0 h. Increased time in employment would logically increase women's monetary return to education and cause women to increase their investment in higher education at a faster rate than men. Figure 8.6 illustrated just that.

While gender differences in labor force participation rates have clearly disproportionately increased women's incentive to invest in education over time relative to men's, further changes are unlikely. Gender differences in the intensity of work have been substantially eliminated. Some difference is likely to persist as a result of gender differences in childbearing. Any future changes are likely to be quite modest and hence have relatively little impact on gender differences in college enrollment.

Gender differences in T have not been the only drivers of the shifting gender gap in education. Changes in the gender wage differential have also been important. Goldin (1986) reports that the ratio of female to male earnings rose between 1890 and 1930 from 0.46 to 0.56. In 1970, this ratio was 0.60, indicating that the gender differential in wages was relatively stable between 1930 and 1970. The median usual weekly earnings of women working full time relative to men working full time have since risen from 0.62 in 1979 to 0.81 in 2010 (U.S. Department of Labor 2011). This increase partly explains and is partly explained by the increase in labor force participation. Higher wages will attract more individuals to work in the labor

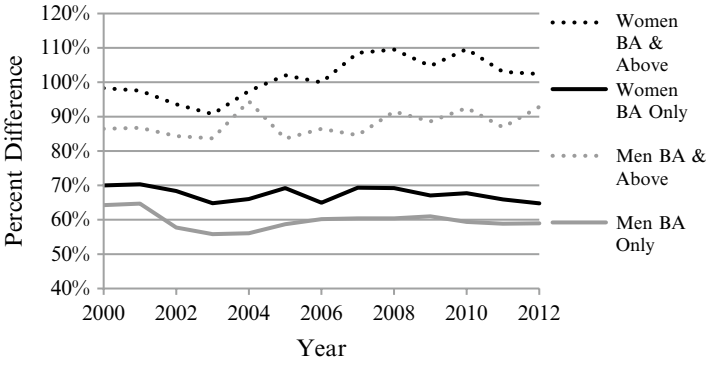

Fig. 8.9 Wage premia by gender & degree
(Source: Numbers generated by author from CPS Outgoing Rotation Groups. Sample restricted to persons age 25–34.)

market. More experience in the labor market is associated with more on-the-job training and higher worker productivity, which translate to higher earnings. What is particularly relevant here are the earnings of female as opposed to male high school graduates – the opportunity cost associated with college enrollment – and the college wage premium for women as compared to men.

The real average hourly earnings by gender of young high school graduates are illustrated in Fig. 8.4. By these measures, the opportunity cost associated with attending college is lower for women than for men and has, at least between 2000 and 2012, been falling for both. The decrease has been slightly larger for women than for men. With a lower opportunity cost than men, women should, ceteris paribus, be more likely to enroll in college than men. Such costs have been lower for all time. With these opportunity costs decreasing more rapidly for women than for men, theory would suggest that women would be increasing their enrollment more than men, at least over the last decade.

The gender-specific hourly wage premium for college graduates aged 25 to 34 is illustrated in Fig. 8.9. This illustration indicates that women have been earning a higher return to a college degree and to a post-baccalaureate degree for over a decade. The average hourly earnings of men with a BA degree only (a post-BA degree) was about 60 % (88 %) higher than the average hourly earnings of men with a high school diploma between 2000 and 2012. The comparable figures for women were 67 and 101 %. Dougherty (2005) provides further documentation of this premium. He reviews 27 cross-sectional studies that provide estimates from standard log wage equations controlling not just for education but also for work experience (or at least age/potential experience). He explicitly excludes studies that control for occupation/industry as such controls typically explain much of the gender premium to education. He further suggests that the returns to college are higher while those to high school lower for women and that women are observed to have a higher return to education in many other countries as well. In his own analysis of data from the National Longitudinal Survey of Youth 1979 (NLS79), he finds that women

receive a statistically significant 2 % higher rate of return per year of education than do men. Assuming college takes 4 years, this estimate would predict an 8 % college wage premium – a measure remarkably close to the 7 % gross differential observed in Fig. 8.9.

The source of this higher college wage premium for women is not entirely clear. Dougherty (2005) attributes half of the differential to discrimination, tastes, and circumstances. He argues that either there is less discrimination amongst more educated individuals or more educated women are able to find employers who discriminate less. Tastes are reflected in occupational choice. Dougherty (2005) suggests that occupational choice may differ substantially more by gender for those with less education than for those with more education. Analysis controlling for high school grades (as a measure of educational quality) and class of employment (as a weak control for occupation) does not change his estimates. A higher rate of return to education for women as compared to men should encourage women to obtain more education than men, the observed outcome.

Gender differences in the opportunity cost associated with a college degree are not limited to wage differences. During the 1960s, men who were enrolled in college were able to defer service in the Vietnam War. Some evidence (Card and Lemieux 2001) suggests that the war increased men's enrollment rates by 4–6 percentage points in the late 1960s. Between 1965 and 1969, the average enrollment rate of men was 13.1 percentage points higher than the average enrollment rate of women. The Vietnam War might explain around a quarter of this difference. Horowitz et al. (2009) report that this additional education may have come at the expense of sisters. Given limited family income, boys who in the absence of high education faced higher risks in the draft may have been given funding priority over their sisters. At the same time, Horowitz et al. (2009) find some evidence of positive education effects for sisters whose parents find it difficult to refuse one child when investing in another. The Vietnam War may, in fact, explain the pattern of rising followed by falling enrollment rates for men between 1960 and 1975.

The direct tuition costs associated with college attendance do not vary by gender, but other costs may. Women's access to colleges was limited for years by single-sex colleges. While all male colleges began to go coed in the 1800s, the elite colleges in the northeast only followed in the 1960s. It was 1983 before Columbia University opened its doors to women. Limited access could have imposed a higher cost on women seeking a college degree 40 years ago (increasing enrollment over time) but is unlikely to be a significant factor today.

Finally, while interest rates on loans do not vary by gender, it is possible that discount rates do. As discussed above, the discount rate will differ based on both risk and time preferences. Croson and Gneezy (2009) in a paper entitled "Gender Differences in Preferences" review the literature on risk preferences. They report that experimental evidence almost uniformly finds men more risk loving than women, with limited evidence that the gender difference may be limited to white persons and to non-managers. Managers may self-select into that occupation in part based on their risk preferences. Evidence from field experiments and financial investments certainly supports a gender differential in risk attitude

(see, e.g., Dohmen et al. 2011b for evidence in the general population and Eckel et al. 2012 for evidence from a student-aged population). If investment in higher education is viewed as a risk, women may be less likely to invest in higher education all else equal than men.

However, there is some debate as to whether risk preferences and time preferences are the same (Andreoni and Sprenger 2012). Some research more explicitly focused on time preferences suggests that men and women have the same discount rate (Harrison et al. 2002). Other evidence suggests women may have lower discount rates – be more patient – than men. Experimental evidence from school-aged children by Castillo et al. (2011) and Eckel et al. (2012) finds girls are more patient than boys, a finding that would support higher college enrollment by girls. For the most part, these studies include few other covariates making it difficult to know how broadly applicable the results might be. Further research on discount rates could provide valuable insight into this element of the human capital model.

Overall, the gender differences in college enrollment that have been observed over the last century appear to match closely the differences that would be predicted from the simple model of human capital, if allowance is made for heterogeneity. Women were less likely than men to enroll in college when their expected labor market returns from this investment were low. With labor market returns rising due to increasing labor force participation rates and increases in the female to male wage ratio, women have begun enrolling at higher rates than men as would be predicted by their lower opportunity cost and higher market returns. These variables have roughly stabilized, making further changes unlikely. Gender differences in work intensity have been substantially eliminated. Gender wage differentials while still evident have been relatively stable. Some differences are likely to persist as a result of gender differences in childbearing. Overall, there is little reason to believe that the current gender difference in college enrollment will change substantially in the future.

Race/Ethnicity

Just as gender differences in enrollment may be attributable to gender differences in the factors influencing enrollment, so might racial and ethnic differences. Again, the discussion proceeds by reviewing the evidence regarding T, the college wage premium, opportunity costs, direct costs, and r.

As before differences in longevity exist (e.g., African Americans have higher mortality rates than whites), but these differences are shrinking and in no case does expected lifetime dip below 60 years after the 1950s. Social security eligibility also does not differ by race/ethnicity. These factors do not explain enrollment differences.

Work intensity does differ and has varied in ways roughly consistent with historical enrollment patters. Figure 8.10 shows labor force participation rates by race/ethnicity for the years 1975 to 2012 for persons aged 25–34. The most dramatic

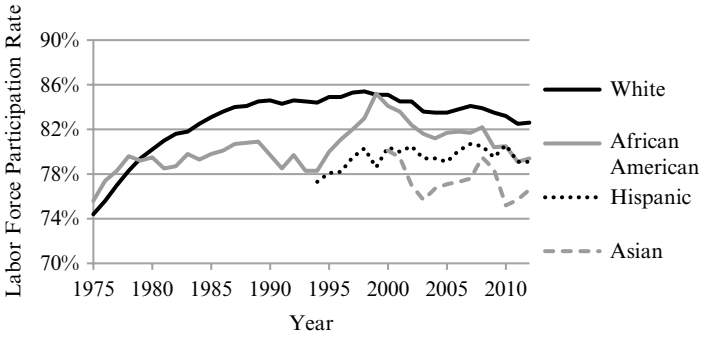

Fig. 8.10 Labor force participation rate by race/ethnicity
(Source: Bureau of Labor Statistics, Series LNU01300113, LNU01300141, LNU01332250, and LNU01300101.)

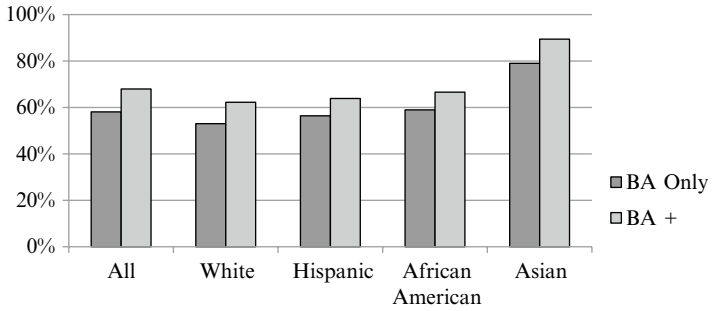

Fig. 8.11 College wage premium by race/ethnicity
(Source: Numbers generated by author from CPS Outgoing Rotation Group, 2012. Sample restricted to persons age 25–34.)

increase occurred between 1975 and 1998 for whites – driven by the rising labor force participation of white women. This period corresponds roughly to the period when enrollment rates were rising most rapidly for whites. Labor force participation rates for African Americans rose from 1975 to 1978 but then changed very little till the mid-1990s – an observation which may explain stagnating college enrollment rates for African Americans. The rapid rise in participation in the latter half of the 1990s reflected the booming economy, but these gains have in large part been lost since. Data for the Hispanic and Asian populations is available only from 1994 and 2000, respectively. There has been a slight upward trend for Hispanics, but no clear pattern is evident for the Asian population possibly because of the small sample size and diverse population. These figures generally support the lower investment in higher education by African Americans and Hispanics relative to whites.

Evidence regarding the college wage premium by race/ethnicity contributes some more towards an explanation of the racial/ethnic differences in college enrollment. The average premiums for those aged 25–34 (in order to at least partially control for experience) in 2012 are illustrated in Fig. 8.11. As compared to the

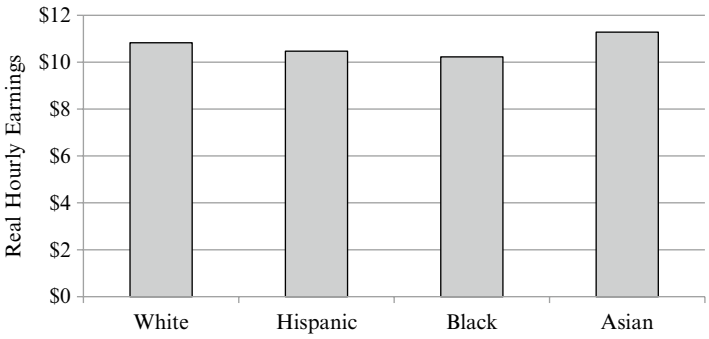

Fig. 8.12 Opportunity cost by race/ethnicity
(Source: Numbers generated by author from CPS Outgoing Rotation Group, 2012. Sample restricted to high school graduates age 18–24.)

population average, whites and Hispanics have the lowest returns. African Americans have somewhat higher average returns, while Asian Americans on average receive a substantially higher premium. These results hold for all the years from 2003 to 2012. Thus, theory would suggest that Asians would have a substantially higher average enrollment rate than whites, African Americans a slightly higher one, and Hispanics about the same.

Opportunity costs, calculated as the average earnings of a high school graduate aged 18–24 in 2012, for each population are illustrated in Fig. 8.12. Perhaps surprisingly there is little difference. In 2012, young Hispanics and African Americans on average earned 3 % and 6 % less respectively than whites, while young Asian Americans earned about 4 % more. Over the 2003–2012 period, the figures are similar, with Hispanics averaging 3 % lower earnings and African Americans averaging 8 % lower earnings. Over the longer term, young Asian Americans had wages comparable to whites. These findings would support slightly higher investment in higher education for African Americans and Hispanics as compared to whites. Overall the evidence from these raw wage data provides support for the higher enrollment of Asian Americans as compared to whites, but little motivation for the lower enrollment rates of Hispanics and African Americans.

The raw differentials presented above fail to control for family background and income or academic preparation, variables likely affecting the enrollment decision (as discussed in the expanded model below) and correlated with race/ethnicity. More comprehensive empirical work estimating the impact of the college wage premium and opportunity costs on college enrollment patterns by race/ethnicity controls for additional covariates and provides greater support for the theory. For example, in an analysis of educational enrollment by whites and African Americans between the 1970s and 1980s, Kane (1994) reports both high school graduation rates and college enrollment rates are negatively related to state average wages. This finding supports the sensitivity of enrollment to opportunity cost considerations. In some specifications, he also controls for an estimate of the college wage differential, finding that whites, but not African Americans, were responsive; however, Kane's

measure is by self-report but a poor proxy that varies little within either sample. Barrow and Rouse (2005) estimate returns to education using what is known as a standard Mincer wage equation in which controls for race, gender, years of education, and a quadratic in potential experience are used to explain the natural logarithm of annual earnings. The coefficient to years of education in this specification represents the annual rate of return to education. They find no evidence of a differential return for African Americans or Hispanics using data from 1980 to 2000 censuses or from the NLSY 1979. This analysis may provide a more accurate measure of returns to education and certainly is more supportive of the observed finding of lower educational achievement for African Americans. One caveat to this work is that no distinction is made between whites and Asian Americans – though if Asian Americans do indeed receive a higher return, the results would be biased towards finding other minorities having a significantly lower return. Jaeger and Page (1996) provide evidence that there is no significant difference between African Americans and whites in sheepskin effects, either. More generally it is important to note that the finding of similar returns to education by race/ethnicity does not imply that there is no wage differential between these groups. If returns to education do not differ by race/ethnicity, then neither should enrollment, ceteris paribus.

The direct costs associated with college do not differ explicitly by race or ethnicity – tuition rates are not listed separately. Financial aid is also rarely distributed based on race/ethnicity per se. Average need-based aid packages will, however, differ by demographic group because of average differences in family income. Census figures (Bureau of the Census 2012) indicate that between 1990 and 2010, median income in African American households has averaged about 60 % that of white households. Median income in Hispanic households has been closer to 55 % that of white households, while Asian and Pacific Islander households have enjoyed 90 % higher median income (190 %) as compared to white households. On average, then, African American and Hispanic (Asian) students likely receive more (less) need-based financial aid and so face a lower net cost of enrollment. Merit aid considerations may move in the opposite direction as students from lower-income households tend to live in school districts that have fewer resources and generally prepare students less. A further discussion of the impact of income and academic preparation follows in the next section.

In addition, access to higher education has quite a mixed history. While blatant discrimination is no longer practiced, other more subtle forms of discrimination may linger. Affirmative action policies were introduced at many institutions in order to increase enrollment by populations historically underrepresented in colleges. Such policies are now under attack. Studies examining the impact ending affirmative action has on enrollment (Backes 2012; Hinrichs 2012) suggest the aggregate impact has not been significant, except perhaps at more selective institutions, but further analysis is warranted.

Research relating discount rates to race/ethnicity is quite limited. Castillo et al. (2011) report that on average, black children are more impatient than white children. This finding is strongest when only controls for race and gender are included in the estimation. The effect is still significant, but only at the 10 % level, when

controls for ability and financial need are added. Eckel et al. (2012) report similar results for risk taking. As these studies are based on rather small samples, the set of control variables is necessarily limited and it is difficult to know if the results are attributable to racial differences per se or to family background. Further analysis of time preference and risk taking could be valuable.

In summary, the simple human capital model could be used to explain some of the observed racial/ethnic differences in enrollment. The lower labor force participation rate of African Americans and Hispanics as compared to whites and the higher estimated return to college for Asians may well help explain why the former are less likely and the latter more likely to enroll in college. However, there are numerous other factors not incorporated in the simple model that are likely to influence college enrollment and differ across these populations. A more complex model that incorporates these other factors is necessary to truly identify the role of race and ethnicity in the college enrollment decision.

Other Source of Heterogeneity

Before proceeding to introduce a more complex model, it is important to point out that while discussion of gender and racial/ethnic differences is common, heterogeneity can arise along any dimension: geographic, institutional, and even individual. The type of heterogeneity addressed here is ex ante heterogeneity – differences observed (or expected) before enrollment occurs. Ex post heterogeneity in the form of, for example, the luck an individual has in the labor market is unlikely to affect enrollment decisions because it is not predictable. However, ex ante heterogeneity can lead any of the factors from the simple (or the more complex) model to differ across the population.

As regards T, employment opportunities differ in different localities and individuals may ex ante have different expectations about their future labor market contributions. Individuals who place a high priority on having a stay at home parent, for example, may be less likely to invest in higher education for the purpose of increasing labor market wages. Individuals may have different expectations regarding their employment horizon for other reasons as well. Individuals with family histories of poor health will, for example, have less incentive to invest in higher education that pays off only in the long run.

Returns to a college degree also vary across the population. Not everyone earns sample mean wages. Indeed, rising wage inequality is a current social concern. In light of this concern, information regarding the distribution of real college earnings for persons aged 25–34 is calculated for the years 1980, 1990, 2000, and 2010. Specifically, earnings at the 10th, 25th, 50th, 75th, and 90th percentile of the distribution are illustrated in Fig. 8.13. The results indicate that there is substantial heterogeneity in the hourly wage outcome, with wages ranging from about $11.50 at the 10th percentile in the distribution to three times higher ($35.50) at the 90th percentile in 1980. If individuals have information ex ante as to what wages

Fig. 8.13 Distribution of earnings for college graduates 1980–2010
(Source: Numbers generated by author from NBER based CPS Outgoing Rotation Groups. Sample restricted to 25–34 year olds.)

they might expect upon completing college, these expectations will influence their enrollment decision.

Wage variation can arise from a number of sources – including choices individuals make. One such choice is that of college major (Thomas 2000; Arcidiacono 2004). It is well known that engineering majors have higher earnings prospects than English majors. College students themselves seem to be relatively well informed about earnings prospects, though much learning occurs nearer graduation than matriculation and the median absolute value of errors is on the order of 20 % – a substantial spread (Betts 1996). Other evidence suggests that many more students believe their major will be science ex ante than actually earn such a degree (Stinebrickner and Stinebrickner 2013). Thus, students likely have some knowledge about their ex post earnings, but that knowledge is by no means perfect and can also vary depending upon economic conditions at the time of graduation which of course are unknown ex ante (Kahn 2010).

Earnings prospects also differ depending upon the college attended (Black and Smith 2004, 2006; Hoekstra 2009). Generally a significant return is observed to college quality (as measured by average SAT score, faculty to student ratio, average faculty salary, or a variety of other statistics), even adjusting for selection effects, though some work suggests the return is larger for individuals from low-income and/or minority households (Dale and Krueger 2002; Andrews et al. 2012). Bound and Turner (2011) provide a review of some of this literature.

Figure 8.13 also indicates that the earnings spread for college graduates has changed, specifically increased, over time. While earnings in the bottom half of the distribution have remained virtually unchanged since 1980, earnings at the 90th percentile have increased to about $40.00 – or 3.5 times the earnings of those at the 10th percentile – as of 2010. It is unclear what knowledge those facing the enrollment decision have of this change but it suggests that the college wage premium

likely increased less at the median than at the mean, reducing incentives to enroll unless everyone expects to be in the upper tail of the wage distribution.

The opportunity cost of college also varies. Employment opportunities for youth vary geographically. Individuals have different skills and skills are not one-dimensional. Individuals who have particularly high earnings potential after high school may well choose not to attend college. Willis and Rosen (1979) provide evidence attesting to such self-selection. As it is not feasible to assume that those at the lower end of the opportunity cost spectrum are those also at the lower end of the college wage spectrum, it is not possible to calculate the distributional characteristics of the college wage premium.

Variability in direct costs and interest/discount rates arises from several sources. Individuals in different states/localities face costs/benefits that differ. In-state tuition and fees at public four-year institutions, for example, ranged from $2,739 in Wyoming to $14,576 in New Hampshire (College Board) in 2012–2013. The correlation between in-state tuition and fees measures and the estimated fraction of 2008–2009 high school graduates in each state going to college in their home state (National Center for Education Statistics 2012, Table 238) is −0.36, indicating that some of the variability in observed enrollment rates is likely related to differences in tuition rates. But tuition and aid generosity also vary from institution to institution, and aid packages vary at the individual level as does family assistance (to be discussed in the next section) and hence effective interest rates. Evidence that individual preferences regarding risk are a function of parental as well as environmental factors indicates that the interest/discount rate also has a range of values (Dohmen et al. 2011a).

All in all, taken to its limit, heterogeneity could explain enrollment decisions completely. Much of the information necessary to explain/identify this heterogeneity is, however, unobservable to investigators. If the goal is to develop a model that can be used to forecast future enrollment and to design possible policy interventions, then relying too heavily on unobserved heterogeneity is not a viable alternative. Expanding upon the model to incorporate additional explanatory factors that drive some of this heterogeneity is in this case a better approach.

A More Complex Model of College Enrollment

The basic model of college enrollment (presented again below) is just that: basic. The

$$\sum_{t=0}^{T} \frac{W_{\mathrm{H}}}{(1+r)^t} \; vs \sum_{t=0}^{3} \frac{-C}{(1+r)^t} + \sum_{t=4}^{T} \frac{W_{\mathrm{C}}}{(1+r)^t}$$

number of assumptions underlying this model is substantial. For example, the model implies that everyone begins college immediately after high school, takes exactly 4 years to complete a degree, does not work while in college, works full time until retiring, retires exactly T years after completing high school, has a wage that

depends only upon educational attainment, derives utility only from earnings, incurs only monetary costs of enrollment, and faces perfect capital markets. A more complete model of the decision to enroll is

$$\sum_{t=0}^{Exp(T_{\mathrm{Hi}})} \frac{ExpU_{\mathrm{i}}\left(W_{\mathrm{Hit}}\right)}{\left(1+r_{\mathrm{i}}\right)^{t}} \; vs$$

$$\sum_{t=0}^{d_{\mathrm{i}}} \frac{ExpU_{\mathrm{i}}\left(W_{\mathrm{Hit}}\right)}{\left(1+r_{\mathrm{i}}\right)^{t}} + \sum_{t=di+1}^{Exp(G_{\mathrm{is}}-1)+d_{\mathrm{i}}+1} \frac{ExpU_{\mathrm{i}}\left(-C_{\mathrm{its}} + \propto_{\mathrm{it}} W_{\mathrm{Hit}}\right)}{\left(1+r_{\mathrm{i}}\right)^{t}}$$

$$+ \sum_{t=Exp(G_{\mathrm{is}})+d_{\mathrm{i}}+1}^{Exp(T_{\mathrm{Ci}})} \frac{ExpU_{\mathrm{i}}\left(W_{\mathrm{Cist}}\right)}{\left(1+r_{\mathrm{i}}\right)^{t}}$$

where Exp is the expectations operator, *U* stands for utility, and *G* is the time it takes to complete a degree. In this specification, individuals delay college enrollment for *d* years and are employed while enrolled α percent of the time. The subscript "H" stands for high school, "C" for college, *t* for time/year, "i" for individual, and "s" for institution. *W* incorporates the probability of employment (taking into account both interruptions and unemployment) as well as earnings, both of which may differ over time as well as with an individual's education. Basically in this expanded model individuals will enroll in college if the expected utility of doing so exceeds the expected utility of not doing so.

Utility is by definition an individual-specific function. Characterizing a utility function exactly is not possible. Preferences may vary along any dimension. As discussed above, controls for gender, race, and ethnicity are often either explicitly or implicitly incorporated in models of enrollment in order to account for preferences but may in fact be controlling for other factors not adequately captured in the model. As stated above, the approach taken here is to try to explain why enrollment decisions differ for observable reasons not related to preferences or unobserved heterogeneity.

In the text above, the focus was first on the employment horizon (*T*), then the college wage premium and opportunity costs, then the direct cost of enrollment, and the discount/interest rate. The text below is organized similarly. The discussion focuses first on retirement age, work hours, and the probability of unemployment as they differ by education level. Each of these variables affects the employment horizon and hence potentially the return to enrollment. Then compensation is examined. An assumption of the basic model was that the compensation differential is fixed over time and equal to the gross hourly wage differential. Wages, however, vary with experience and so does the premium. Benefits packages and taxes also play a role. Previously the cost of enrollment was assumed to be limited to the opportunity and direct costs. Individuals were assumed to be unemployed when enrolled and to be able to borrow to finance their education. College was assumed to take exactly 4 years and to have no nonmonetary costs and no consumption value. When these assumptions are relaxed, the local unemployment rate, individual ability, family income, and family background all become cost related.

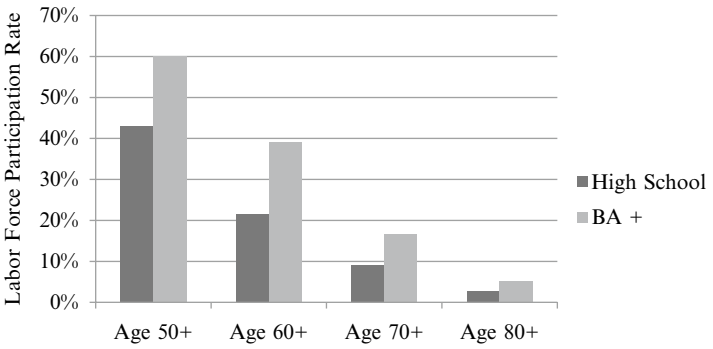

Fig. 8.14 Labor force participation rate by education and age (Source: 2012 CPS statistics compiled by the author.)

Education and the Employment Horizon

Retirement

The basic human capital model assumes that everyone has the same working life. In fact, working life differs substantially across the population. Already documented above are some average differences by gender, race, and ethnicity. Here the focus is on how work life differs by education level, looking at retirement patterns, hours worked, and unemployment rates. To the extent that these differences are expected ex ante even if they are driven by the investment in education which increases the opportunity cost of time, they contribute to the enrollment decision. To the extent that these differences are due to selection, differences between those who do and do not invest in higher education, their impact on the enrollment decision will be muted.

The median age of those who self-report they are retired in the 2012 CPS is surprisingly high at 72 and differs little by education level. However, this statistic fails to capture differences in labor force participation by age which are substantial. Figure 8.14 shows that for those aged 50 and above with exactly a high school degree, the labor force participation rate is 43 %, while for those with a college degree or more, the labor force participation rate is 60 %. College degree holders aged 50 and above are about 40 % more likely to participate than high school degree holders aged 50 and above. This differential rises above 80 % for older persons. As the labor market was still recovering from a recession in 2012, results for 2007 were also obtained. They differ only in that the labor force participation rate of more educated persons is generally lower in 2007 for those aged 60–80. The basic finding that the labor force participation rate of older persons is higher for those with more education is unchanged.

Research on retirement confirms that more educated individuals retire later than less educated individuals (see, e.g., Hanel and Riphahn 2012). What is a matter of

debate is the reason for this differential. Some portion is likely attributable to health differences. Manual labor, more typical of jobs requiring less education, becomes more difficult as individuals get older and disability may become more common. Indeed, there is evidence that as the full retirement age in the USA rose from 65 to 67, there was a partially compensating increase in Social Security Disability Insurance enrollment (Duggan et al. 2007). This discussion underscores the value knowing family health history may have on predicting enrollment.

Opportunity cost also plays a role. More educated persons have higher earnings, making retirement more costly. On the other hand, more educated individuals have higher incomes and might be able to accumulate more wealth in order to retire early. There is some evidence that more educated persons find a middle road by easing into retirement with part-time jobs (Kim and DeVaney 2005). In general, however, few enrollment decisions are likely to hinge on retirement decisions. Any earnings received at age 60 plus are heavily discounted by teenagers making college enrollment decisions, not only because of the impact of the discount rate but also because of the uncertainty associated with outcomes so far in the future.

Hours Worked

Just as years in the labor force are important, so are hours worked while in the labor force. Theory cannot predict the impact higher earnings will have on hours worked. Higher wages increase the opportunity cost of leisure, causing workers to increase their time on the job and consume more market goods and less leisure. However, higher wages also generate higher income with which workers may "purchase" more leisure. Both the evidence on retirement age and the evidence on hours worked suggest that the income effect is dominated by the substitution effect. On average, college graduates work more hours per week than high school graduates. Usual hours worked per week in 2012 averaged 38.5 for high school graduates and 40.9 for college graduates. The fraction of high school graduates employed part time (defined as less than 35 h per week) in 2012 was 16.8 %; for college graduates, the figure was 11 %. This increased work time magnifies the earnings differential associated with a college degree.

Unemployment

In the previous discussion of the impact of gender on the decision to attend college, gender differences in labor force participation were highlighted. In the discussion of retirement, educational differences in labor force participation were highlighted. However, labor force participation does not guarantee an income. To be in the labor force, one must either be currently employed or unemployed. While some of those classified as unemployed receive unemployment insurance benefits, many do not. Thus, it is important to look at unemployment rates by education level as well as labor force participation rates by education level. Unemployment is also less likely a decision or choice individuals make, more likely exogenous.

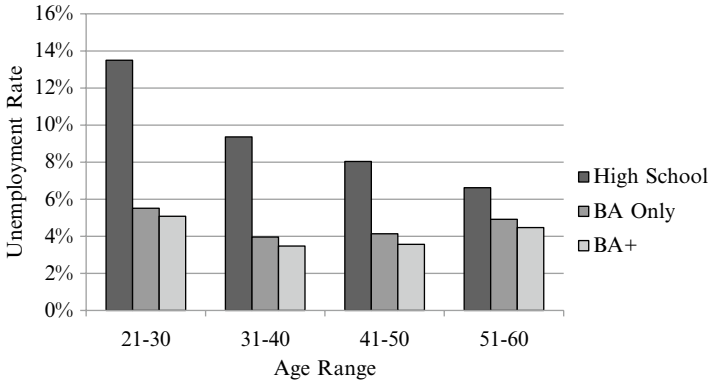

Fig. 8.15 Unemployment rate by age and education
(Source: 2012 CPS statistics compiled by the author.)

Unemployment rates in 2012 by education level and age are presented in Fig. 8.15. The unemployment rate of those with only a high school degree declines steadily with age; however, the fact that it is highest for younger workers means that incorporating the unemployment rate reduces the net present value of high school earnings more than proportionally to the unemployment of high school grads as a whole. The time value of money discounts the lower earnings of younger workers less than the higher earnings of older workers. The unemployment rate of college graduates is considerably lower at all ages than the unemployment rate of high school graduates and follows a different age pattern. The average unemployment rate of college graduates has a u shape by age, declining from a high for new graduates to a low for those of middle age and rising more for those over age 50. This shift may occur because the knowledge acquired by college graduates depreciates and makes older college graduates somewhat less valuable. However, the year 2012 was not a spectacular one for the labor market generally. The higher unemployment rate of older more educated individuals in 2012 could arise if older less educated unemployed individuals were more likely to qualify for disability pay and exit the labor force. In order to ensure that these results are not unique to 2012, figures for 2007 were also generated. The unemployment rate in 2007 was clearly much lower than that in 2012. While the unemployment rate for high school graduates aged 21–30 in 2012 was about 13.5 % (8 percentage points) above the unemployment rate for those holding only a bachelor's degree, the unemployment rate for high school graduates aged 21–30 in 2007 was only 7.5 % (less than 5 percentage points) above the unemployment rate for those holding only a bachelor's degree. In each year, the unemployment rate of college graduates aged 21–30 was only about 40 % as large as the unemployment rate of those holding only a high school degree.

While the relation between the unemployment rate and education level is similar between 2007 and 2012, the magnitude of the differential is significantly larger in 2012, suggesting that the differential may vary over the business cycle. Unemployment rates by education level for those aged 25 and over from 1992 to

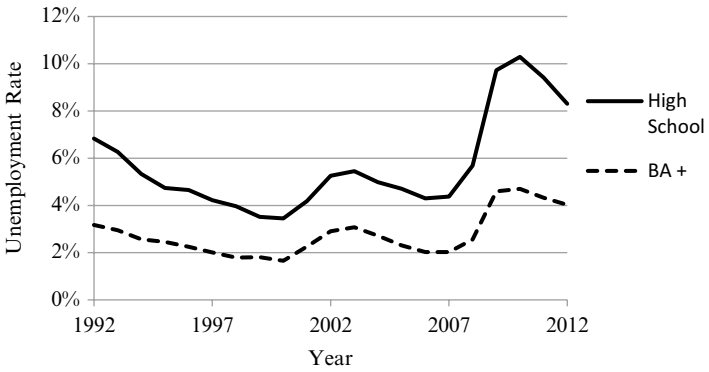

Fig. 8.16 Unemployment rate by education level
(Source: Bureau of Labor Statistics, Series LNS14027660 and LNS14027662.)

2012 are presented in Fig. 8.16. They clearly show lower unemployment rates for those with a college degree at all points in time. No time trend is evident in this differential; however, as suggested by the earlier comparison, the raw differential does appear to be greater when the unemployment rate for those holding only a high school degree is greater. Those with more education experience less employment volatility during business cycles than those with less education.

These empirical observations have simple theoretical explanations. That more educated persons might have a lower probability of being unemployed than less educated persons can be explained by search theory. Job search models are used in labor economics to describe and explain how individuals find jobs. Suppose information is imperfect. Individuals seeking a job must visit employers to submit applications and receive job offers, but individuals do not know which employers have vacancies and so cannot target their job search. Suppose too that firms have certain skill requirements. An application results in a job offer only when there is a vacancy for which the applicant has the necessary skills. Individuals with less education have less skill and will be less likely to meet these skill requirements. Assuming individuals are able to complete only one application each period, less educated individuals will be less likely in any period to receive a job offer because they are more likely not to meet the minimum skill requirements. Assuming all job offers are accepted, these assumptions alone would imply that less educated persons will have a lower probability of receiving job offers and so have higher unemployment rates than more educated persons.

Not all job offers will, however, be accepted. Each job offer constitutes a wage offer. That wage offer is a function of the skill required for the job. Applicants have the option of turning down job offers and continuing to search. Thus, more educated workers may reject jobs paying only $8 an hour if there are jobs at which they could earn $20 an hour. Theory suggests that each individual will identify what is called a reservation wage – a wage such that he/she will be just indifferent between accepting and rejecting a position. Higher reservation wages mean a lower probability of

receiving an acceptable job offer. This reservation wage will be identified as that wage at which the net benefit of accepting the offer is exactly equal to the net benefit of rejecting the offer. That is what being indifferent means. To keep the model more tractable, wages are assumed to be invariant over time, employment is assumed to last for a fixed time period, and search while employed is not possible. The net benefit associated with accepting a particular wage offer is the net present value of future earnings at that wage level. The net benefit associated with rejecting a particular wage offer is the expected net present value of future earnings from continuing search. Future earnings are a function of the probability of receiving a job offer with a wage above the reservation wage as well as the expected wage associated with such an offer. Higher reservation wages lower the probability of receiving an acceptable wage offer but increase expected earnings once a job is accepted. Reservation wages will be higher for those who have more education (a higher skill level) than for those who have less education, but the probability of receiving an acceptable job offer will also still be higher than it is for less educated individuals. Thus, the theoretical prediction that search unemployment will be greater for less educated workers continues to hold.

That the unemployment rate of less educated workers might be more responsive to economic conditions than the unemployment rate of more educated workers can be explained if there are quasi-fixed costs of employment that are positively correlated with worker education. Variable costs in economics are costs that can be avoided in their entirety when no output is produced. Thus, the owner of a pizza parlor need not buy cheese or flour if his or her plans are to shut down operations for a month. The costs associated with raw materials that are purchased to order are purely variable.[5] Fixed costs are costs that must be paid regardless of whether output is produced. If the pizza parlor rents its facilities, these lease payments are due whether or not any pizzas are sold. Lease payments constitute fixed costs. Quasi-fixed costs are partly fixed and partly variable (Oi 1962). Labor costs are typically quasi-fixed. The wages of workers paid by the hour are purely variable, while salary payments are more nearly fixed. Hiring costs, on-the-job training costs, and the costs associated with terminating employees are all fixed. Vacation leave is typically proportional to hours worked and so variable, while medical and life insurance benefits are per employee and so more fixed in nature.

Firm demand for quasi-fixed resources is less sensitive to changes in the business cycle than firm demand for variable resources. Consumer demand falls during recessions. If less output is demanded, firms will produce less and so need fewer resources. In the case of variable resources, resource demand falls proportionally to output demand. In the case of quasi-fixed resources, resource demand falls *less* than proportionally to output demand. So in the case of labor, firms will not hire unless the expected benefits associated with a hire are greater than or equal to the expected costs. All benefits and costs (both fixed and variable) are taken into account at the time of hire. If there are any fixed labor costs, then workers' per period earnings or

[5] Resources that are purchased under contract are not purely variable if a minimum quantity or a minimum payment is required.

wages must be sufficiently less than their per period value to the firm in order for the firm to recoup these fixed costs. Once hired, however, any fixed costs that have already been incurred, such as hiring and training costs, are sunk costs that the firm cannot recoup no matter what it does. Thus, in deciding whether or not to keep an employee on the payroll all that matters are the future costs and benefits. If a recession occurs and the value of the worker to the firm falls, the fact that wages were lower than the per period value of the worker before the recession hit provides a bit of a cushion. Firms will not have an incentive to immediately lay off workers. The greater the hiring and training costs, the less the incentive to immediately reduce employment. All that is necessary for the variability of the unemployment rate to be lower for more educated workers is for more educated workers to have higher hiring and training costs than less educated workers and for all those laid off to remain in the labor force.

There exists substantial empirical evidence of a positive relation between education and on-the-job training (Mincer 1991; Lynch and Black 1998). There also exists substantial empirical evidence of a negative relation between education and unemployment. Mincer (1991) reports that the probability of becoming unemployed is lower for more educated workers. Riddell and Song (2011) find that more educated individuals have a higher probability of exiting unemployment. Hirsch and Schnabel (2012) find that more educated workers are more likely to move directly from job to job and less likely to go from employment to nonemployment. That more educated workers have lower unemployment rates and unemployment rates that are less sensitive to business cycles provides additional motivation for pursuing higher education.

In general, recognizing that the employment horizon may vary with education levels acts primarily to further motivate college enrollment. There is little evidence these differences have changed over time and can explain changes in enrollment behavior.

The Compensation Differential

A further analysis of how compensation packages differ for college and high school educated workers provides at least some theoretical support for increased enrollment over time. The simple model assumes that compensation consists only of gross wages and that these do not vary with work experience. Given these assumptions, the college wage premium is fixed over the lifetime. Reality is more complicated in at least two dimensions. First, the wage premium clearly varies with age/experience. Second, gross wage differentials alone are not sufficient to describe the benefits associated with a college degree. Taxes and benefits packages also matter.

The Age/Experience Profile of the Wage Differential

Figure 8.17 illustrates average hourly earnings for workers by age and education level in 2012. Average hourly earnings rise by about $5 or 38 % with age for high school graduates while they rise by $10–$12 or over 50 % for college graduates.

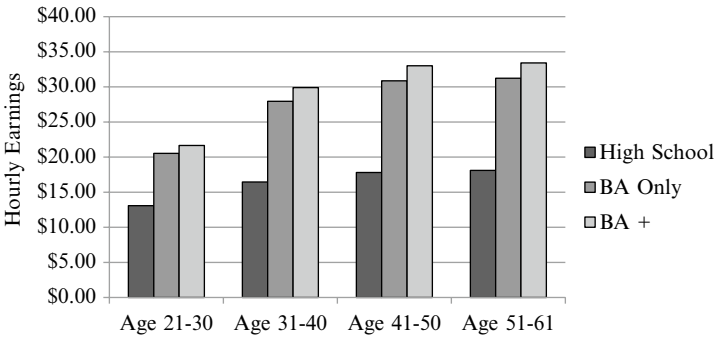

Fig. 8.17 Hourly earnings by education and age
(Source: 2012 CPS statistics compiled by the author.)

As a result, the college wage premium rises from 57 % for those aged 21–30 to 73 % for those aged 41–61. The premium incorporating the possibility of post-graduate education rises from 65 to 84 %. As there is evidence that wages are lower during periods of high unemployment, 2007 earnings were also examined (not shown here). The earnings of college graduates aged 21–30 are higher in real terms in 2007 than in 2012, but the gradient and the premium still rise with age. That the age-earnings profile is positively sloped for all workers is likely attributable to investment in on-the-job training. That the gradient is larger for college graduates than for high school graduates suggests, as was hinted at above, that college graduates receive more such training than high school graduates. A rising age differential suggests there is a greater incentive to invest in a college degree than was evident looking only at recent graduates, though as was discussed with respect to longevity differentials, discounting reduces the face value of differentials that occur later in time.

The Benefits Differential

The focus so far has been upon gross hourly earnings, but average benefits and tax levels also differ for high school and college educated workers. While workers do not typically choose their benefits packages except in so far as they choose their employers, the average education level of employees does differ across employers.[6] Employee benefit surveys conducted under the supervision of the Bureau of Labor Statistics (U.S. Department of Labor 2013) provide some information on

[6] An underlying assumption of this discussion is that given the same income, those with less education would make the same consumption choices as those with more education. In fact, different individuals will value benefits differently. If less educated individuals place a lower value on benefits, then they will be less likely to receive them. So long, however, as they place a positive value on benefits, different benefits levels by education level still contribute to the compensation differential; it is only the value of the differential that is reduced.

the fraction of all private workers with access to various benefits as well as the fraction in particular occupations with access to these benefits, for the period 1999–2012. Educational attainment differs substantially by occupation. Sixty-nine percent of "professional and related workers" in the private sector have at least a college degree according to data from the 2012 CPS; only about 10 % have no more than a high school degree. This occupational category is used to proxy for college educated workers. As only 8 % of "production, transportation, and material moving" workers (henceforth called production workers) have a college degree and fully 49 % have exactly a high school diploma, this occupational category is used to proxy for high school educated workers.

There are some substantial differences in access to benefits between these occupational groups. Similar fractions of professional and production workers have access to paid holidays and paid vacations – 85 % and 83 %, respectively. Paid sick leave is by contrast available to about 83 % of professional workers but only 54 % of production workers. Access to medical/health care also differs by occupation. While 83–85 % of professional workers have access, only 75–77 % of production workers do. Furthermore, the time trend in access to medical care appears to be weakly positively sloped for professional workers and weakly negatively sloped for production workers, a result that if true would tend to increase the benefits associated with a college degree and hence increase enrollment over time. Access to retirement benefits and childcare benefits also varies considerably by occupation. While a similar fraction has access to the defined benefit plans that are becoming less common, the fraction of professional workers with access to a defined contribution benefit plan is 18 percentage points higher (73 % versus 55 %) than the fraction of production workers with such access. Relatively few workers have access to childcare (9 % of all private workers), but 18 % of professional workers do as compared to 4 % of production workers.

That more educated and hence more highly paid employees would receive higher benefits is quite logical. On the supply side, firms can obtain some of these benefits (particularly health benefits, but also retirement plans) at a lower cost than individuals could, making such benefits more attractive to all workers. On the demand side, paid holidays and paid vacations constitute additional leisure. Individuals with more income will naturally want to purchase more leisure and more goods with that income. That we see more leisure obtained in the form of holidays and vacation days rather than earlier retirement or fewer hours worked per week may be attributable to the fact that these holidays and vacation days occur earlier in time. Retirement benefits provide workers with the opportunity to defer some income into the future. Workers with lower incomes are likely less willing to make this trade-off than workers with higher incomes, and workers with less education may value such benefits less if one reason they obtained less education was because they have a higher discount rate. Finally, those with higher incomes may experience tax benefits by pushing some income into the future, making this option even more attractive for them. Indeed, higher-income individuals may experience tax advantages for many benefits options.

Taxes

The progressive tax system in general, however, acts to reduce the benefits of acquiring a college degree. Marginal tax rates increase with increasing income, effectively reducing disposable income more for more educated than for less educated persons and reducing the monetary benefit associated with a higher degree. Tax rates are legislated and hence somewhat difficult to predict ex ante. If one were to anticipate higher marginal tax rates for higher earners in the future, that would reduce the perceived benefits of a college degree and act to reduce enrollment. Given current levels of debt in the USA and popular concern about income inequality, it may be reasonable to expect higher tax rates in the future, but such predictions are far from certain.

Opportunity Cost Revisited

The other manner in which earnings enter into the decision to enroll is via opportunity costs. Evidence has already been presented to show that the real earnings of those with only a high school degree have been decreasing. This wage measure constitutes the opportunity cost of going to college only if all those not enrolled are employed (or engaged in another activity that has an even higher value) and all those enrolled are not employed. The evidence is clear that both these assumptions are violated.

Analysis of the labor force participation rate of 16–23-year-old high school graduates not enrolled in college full time indicates a high rate of participation that has fallen relatively little between 2007 and 2012 – from just under 80 to 77 % – despite the intervening recession. Thus, most individuals who are of traditional college age are either enrolled or in the labor market. Not all those in the labor market, however, are employed. The unemployment rate of college-aged individuals is substantial and has risen from 12 % in 2007 to 21 % in 2012. The opportunity cost of attending college is lower than would be indicated by the wage alone and much higher during bad economic times than it is during boom times. Research supports this conclusion (Dynarski 2002; Clark 2011) though it may be important to control for youth not aggregate unemployment as some analyses using the latter find insignificant effects (Kane 1994). Some of the increased enrollment observed post 2007 likely reflects the poor labor market alternatives.

Analysis of the labor force participation rate of students indicates that a substantial fraction is employed. October CPS data on 16–24-year-old full-time college students documents that the fraction employed rose from 33 % in 1970 to a peak of 52 % in 2000 (National Center for Education Statistics 2012, Table 442). Employment rates hovered around 48 % in the early 2000s, before falling during the recession to 40 %. Of those employed, the fraction working for less than 20 h per week hovered around 20 % from 1970 through 2000 and then dropped to 15 %. The fraction working 20–34 h per week rose from 10 % in 1970 to 20 % in 1995, remaining at this level till the recent recession. The fraction working full time rose from

between 4 and 5 % through 1990 to 9 % in 2005, falling thereafter to 7 % in 2011. Employment while in college, ceteris paribus, increases the probability of enrolling because it reduces the cost of enrollment. Why, however, has employment while enrolled been increasing?

Scott-Clayton (2012) explores this question. She considers the role of changing demographic composition, economic conditions (using state unemployment rates to proxy for earnings potential), the rising cost of college, the availability of work-study programs, increased interest in work experience, changes in the return to college, and institutional crowding. She concludes that compositional changes and the expansion of the federal work-study program likely explained much of the increase in employment from 1970 to 1982, while compositional changes and economic conditions dominated from 1983 to 1993. Economic conditions post 1993 and rising tuition and changing student aid between 1993 and 2005 were identified as the key factors for the later period. Kalenkoski and Pabilonia (2010) report weak supporting evidence that hours worked increases when the cost of attending college rises and parental transfers fall. The cost of higher education appears to be key.

Paying for Higher Education

Overall, altering the model to incorporate further differences in the employment horizon, in returns, and in opportunity cost does more to enhance evidence of the benefits associated with a college degree than to explain heterogeneous patterns of behavior or trends in college enrollment over time (except those induced by the business cycle). Extending the model now to consider how students pay for college as well as further enrollment costs yields substantially more evidence of heterogeneity. Previously the cost of enrollment was assumed to be limited to opportunity costs and tuition costs. Individuals were assumed able to borrow in the market to finance their education. When these assumptions are relaxed and psychic costs are recognized, family income, family background, and individual ability all become important determinants of enrollment. The role of these and other cost-related measures on the enrollment decision is discussed below.

Access to Capital Markets

Capital markets readily provide financing to firms making capital investments that are expected to pay back a high enough rate of return to cover expected borrowing costs and risk. New firms often have to provide substantial documentation justifying their need in order to obtain financing because they are perceived as relatively risky investments. Older firms are able to rely in part on their reputations to keep down the risk-related cost. In worst-case scenarios, banks can repossess firm assets in order to recover their investments. High school graduates seeking money to pay for college are in an entirely different applicant pool. While as argued above there is a substantial return to a college degree, 18-year-olds have no credit history and it is

not possible to repossess an applicant's college degree. Without access to some physical collateral, the risk associated with college loans is substantial and banking firms will either be unwilling to offer such loans or will require signature guarantees from customers with good credit scores. It is for this reason that the government intervenes to back many student loans. The government also has the advantage of being more easily able to garnish earnings to collect on delinquent accounts.

The amount of money one can legally borrow from federally backed sources to pay for college and the interest rate charged on that money varies substantially with the particular loan program being utilized and over time depending upon the vagaries of the federal legislature. Rate information for unsubsidized student loans was discussed earlier and presented in Table 8.1. This type of loan is available to virtually any student completing a FAFSA form. Subsidized loans are available to those from lower-income households and have in some years had lower interest rates. Direct PLUS loans are offered to parents at generally higher cost. Work-study options also help to provide students with money for continuing their education. Each of the many programs in place has somewhat different conditions and charges (see Lochner and Monge-Naranjo 2008 for some further description). Most programs require completion of a FAFSA form on which students and parents are required to identify income and assets. Loan limits are typically well below those necessary to pay for a private college.

Given the plethora of different financial aid options available, it is perhaps not surprising that researchers in this area have had to limit their focus. Some research has found many students in need of funding are turned off by the complexity of the application process (Bettinger et al. 2012). Hoxby and Avery (2012) present evidence that high-achieving low-income students may be particularly stymied as they appear to end up paying more to attend lower-quality institutions. Evidence regarding the impact of grants versus loans versus work-study aid on college enrollment is limited because data on the options applicants face are rarely available. In an analysis that focuses only on the decision to enroll or not, St. John (1990) uses information on college applicants and finds that sensitivity to tuition and different types of aid varies by family income. DesJardins et al. (2006) analyze the enrollment decision process using data from a single institution, finding that both expected and actual aid offers play a role. Seneca and Taussig (1987) have rather unique data on students admitted to both Rutgers and at least one other institution, data that include information on both the tuition charged and the aid offered by each institution. Avery and Hoxby (2004) have similar data for a set of high-ability students. As expected net cost is a significant factor, with aid offers having very large effects. For those interested in collecting data, individual-level data on the schools to which students apply, the application and aid outcome at each school, and the student decision regarding enrollment would provide a potential treasure trove of information for examining the role of cost factors in the enrollment decision.[7]

[7] The impact of the different types of financial aid has been studied much more extensively in the literature on persistence (see, e.g., St. John and Starkey 1995; DesJardins et al. 1999).

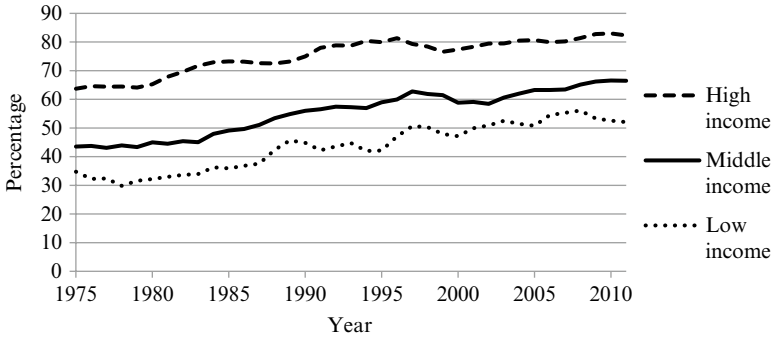

Fig. 8.18 Fraction enrolled by household income
(Source: *Digest of Education Statistics*, 2012. Table 236. Persons age 16–24 who completed a high school degree or GED within previous 12 months.)

Family Support

While information on aid received and tuition charged can be difficult to obtain and is after all contingent on applying to college, information on family income, parental employment, and parental education is not. These measures are often included in studies to capture ability to pay. Parental education is important because of the strong link between education and earnings. Indeed, parental education likely captures potential or long-run earnings and has some value as a measure of ability to pay even when controls for family income are included. Further evidence that money plays some role in the enrollment decision is also apparent in the recent literature linking wealth and changes in wealth to college enrollment (Belley and Lochner 2007; Lovenheim 2011; Lovenheim and Reynolds 2013).

That enrollment rates vary by household income is well known. Figure 8.18 illustrates the fraction of recent 16–24-year-olds enrolled in college in 2011 by household income. Low income here refers to households in the bottom 20 % of the income distribution, while high income refers to households in the top 20 % of the income distribution. The enrollment rate of those from higher-income backgrounds is substantially higher than that for those from lower-income backgrounds. In 2011, 82 % of those from higher-income households were enrolled in college within a year of completing high school as compared to 66 % of those from middle-income households and 52 % of those from lower-income households. Enrollment for all groups has increased over time, but the difference has remained remarkably stable at 30 percentage points since 1975. Cameron and Heckman (2001) present fairly similar figures using data from October CPS files beginning in 1970. What is not apparent in Fig. 8.18 is that the 1970 to 1980 period was rather one of decreasing not increasing enrollment for all groups.

Though not illustrated here, the differences in college enrollment by parental education are also substantial. The more educated an individual's parents, the more likely he or she is to attend college. Parental education is, of course, closely

related to parental income, but each appears to play a separate role. Haveman and Wolfe (1995), in a review of the literature looking at child outcomes, document the importance of parental education, citing its link not only to household income but also its relation to both the quantity and quality of the goods and time parents invest in their children. They report that parental education is almost always found to be significantly positively related to children's educational outcomes, with mother's education mattering somewhat more than father's and the effect being substantial. By contrast, they report that household income usually has a positive impact that is statistically significant about half the time, but typically rather small in magnitude. The latter finding likely reflects the fact that they do not focus exclusively on college enrollment but also look at the decision to complete high school. In the case of college enrollment, family income likely becomes more important because of the greater costs involved. Public high school entails no direct costs. Parental education when looking at college enrollment may proxy for parental knowledge of postsecondary education and familial support for education.

Studies of college enrollment and degree receipt indicate both income and parental education have significant associations. Kane (1994) provides evidence that parental education has a substantial impact on college enrollment for both white and African American children and indicates that much of the increased enrollment of African Americans observed in the late 1980s can be attributed to the greater parental education of those entering at that time. He controls for household income in these analyses, as well as for net cost. While generally finding that greater household income is associated with higher enrollment and greater net cost is associated with lower enrollment, Kane (1994) also finds that the effect of an increase in net cost on college enrollment is greater for children from low-income households than for children from high-income households, particularly for white families. Indeed, white children from high-income households did not appear to reduce enrollment in response to higher net costs at all, though African American children even from high-income households were sensitive to increased net costs. St. John (1990) and McPherson and Schapiro (1991) also report evidence of differential responses to net cost or tuition/aid by household income. These findings are suggestive that ability to pay matters in college enrollment decisions.

Academic Background/Ability

Differences in academic preparation and ability are also associated with differences in educational attainment. These factors are linked to the cost of enrollment in several ways. Less prepared and less able students may find it harder to keep up in college. They may have to spend more time studying, take remedial classes, or hire tutors. Their probability of graduating may be lower and their expected time to graduation longer. If college has a nonmonetary consumption value, less able students may on average find this consumption value is lower since they have to work harder to succeed.

Research clearly supports this link. Belley and Lochner (2007) highlight the importance of ability (as measured by AFQT scores) on higher educational attainment over a 20-year period. Adelman (1999) documents the importance of high school curriculum, test scores, and class rank/academic GPA on bachelor's degree receipt, finding a somewhat higher correlation with curriculum than either test scores or class rank. Many researchers include SAT scores and/or high school grades in models of college enrollment, persistence, and completion (e.g., Venti and Wise 1982; Stratton et al. 2008; Cragg 2009) finding highly significant associations.

Differences in ability and academic preparation have, however, also been closely linked to household characteristics. As many researchers have pointed out, the decision to enroll in college is not made in an instant but follows years of preparation. Individuals must believe that college enrollment is possible in order to put forth that effort (see, e.g., Daun-Barnett 2013), and such belief likely depends on ability to pay. Cameron and Heckman (2001) using the NLSY79 highlight the sequential nature of the college enrollment decision. College enrollment is conditional upon completing high school and all the grades before. Family income and parental education are important determinants at each level, though with a decreasing effect at higher grades (Cameron and Heckman 1998). Modeling progress through the education system from age 15 onward, Cameron and Heckman conclude that short-run credit constraints, such as might impact college enrollment conditional upon high school attainment, are not as much of a barrier as the long-run income constraints that influence the academic preparation and test scores that precede such enrollment. In a similar analysis, Carneiro and Heckman (2002) find that at most 8 % of the population experiences short-run credit constraints.

Some research suggests that income may be playing a greater role in the enrollment decision now. Belley and Lochner (2007) reproduce earlier results using NLSY79 data but find different effects using similar data from the more recent NLSY97. Ability (as measured by AFQT score) continues to have a significant and substantial association with educational attainment. Family income, while having a similar effect over time on high school completion, has a substantially stronger impact on college enrollment for the more recent cohort even after controlling for ability, parental education, and many other covariates. The fact that much of the increased college enrollment between these cohorts has occurred among high-income, low-ability students also suggests that ability to pay is a concern.

Race and Ethnicity Revisited

Controlling for ability and family background also influences the estimated effects of race and ethnicity. Cameron and Heckman (2001) and Belley and Lochner (2007) find that African Americans and Hispanics from the NLSY79 are significantly more likely to attend college all else equal than whites after controlling for parental education, household income, and ability. While Belley and Lochner (2007) find similar results using data from the 1997 NLSY cohort, the magnitude of the differential is much smaller. Adelman (1999, 2006) finds race and ethnicity to be statistically insignificant

in similar equations examining college completion with the High School Class of 1982 and NELS 88/2000. Overall, these results suggest that race and ethnicity per se are less important than family income/background or academic preparation.

Gender Revisited

The effect of controls for ability and family background on the gender difference in higher education is quite different. There is ample evidence that women have long had better high school grades than men. There is also evidence that women's test scores in both math and reading have increased relative to men's and that women have increased their academic preparation for college relative to men (Goldin et al. 2006). These gender differences would predict women having a higher and rising college enrollment rate as compared to men and thus are consistent with rising gender differences in enrollment. Goldin et al. (2006) suggest that cultural norms may also have played a role in this gender differential. They find that while higher-income households have always been fairly even handed in their support of higher education for sons and daughters, there is evidence that lower-income households historically gave preferential treatment to sons. Cultural norms can impose substantial costs on those following divergent paths.

Other Cost-Related Factors

Related analyses find additional cost-related factors important. For example, there is evidence that the characteristics of the other students in one's high school matter for one's own enrollment decision. Students from high schools in which a greater fraction of students take college preparatory exams are more likely to enroll in college (Johnson 2008). This finding could be interpreted as a peer effect. This is true even after controlling for the student's own test score, but the analysis does not control for family income or parental education. Results on peer effects in general are mixed. Sacerdote (2001) finds significant evidence of peer effects on freshman-level GPA by randomly assigned freshman roommates at Dartmouth, but Foster (2006) finds no evidence using either randomly assigned or social friends at the University of Maryland. In an analysis more directly related to college enrollment, Bifulco et al. (2011) report that students are more likely to attend college if their peers' mothers are more educated. Johnson (2008) also finds evidence that students from high schools located geographically closer to a college are more likely to enroll in college. This finding has been replicated numerous times including by Frenette (2006) and Alm and Winters (2009), though Hoxby (2009) argues that students are becoming increasingly less sensitive to geographic distance. Whether geographic distance is a measure of dollar cost or familiarity is difficult to determine.

Evidence is also accumulating that students are taking longer to complete the bachelor's degree. Bound et al. (2010b) look at two cohorts of high school students two decades apart in time. They find that 58 % of those graduating from high school

in 1972 and completing a college degree complete that degree within 4 years, as compared to only 44 % from a comparable 1992 cohort. They also show that students are not accumulating more credits, and for that reason taking longer to graduate, but rather accumulating credits more slowly. Even the probability of completing a college degree falls between these cohorts – from over 45 % to under 40 % (Bound et al. 2010a). Longer time to degree and greater uncertainty means a higher cost and should, ceteris paribus, reduce enrollment.

Delayed Enrollment

The more complex model also recognizes delayed enrollment. CPS data on enrollment rates indicate that in 1974, 24.4 % of all undergraduates were aged 25 or older. This figure rose to 33.1 % in 1994, fell to 26.9 % in 2003, and was reported to be 29 % in 2011 (Bureau of the Census 2012, Table A-7). In the simple human capital model of college enrollment, everyone enrolls immediately after completing high school. This is a prediction of the model rather than an assumption. Since older persons are likely to have acquired some on-the-job training and hence have higher earnings, their opportunity cost of enrollment will be higher. Furthermore, since they have a shorter future time horizon, their benefits are lower. The net present value of future enrollment will be larger for younger than for older persons.

Delayed enrollment could be optimal if the opportunity cost of attending college is high and declines following high school graduation. Such could be the situation for those who marry and/or have children while in high school. The advent of a major recession could also induce some to return to school. Finally, some may feel the need to work and save money for college. Horn et al. (2005) show that students who delay are more likely to be minority students from lower-income households, to have less educated parents, and to enroll part time. Nevertheless, even for older students elements of the standard model are good predictors of enrollment behavior. In a fairly unique study of the college-going behavior of persons aged 25 to 65, Jepsen and Montgomery (2012) find that even for this group, the probability of enrolling declines with age and with current earnings (a measure of opportunity cost). Women are more likely to enroll, while married persons and those with children are generally less likely. Race and ethnicity do not have a consistent association, but residence near a college increases the probability of enrollment. Thus, though the population is unusual for an analysis of college enrollment, common theoretical predictions regarding age and opportunity cost are generally supported.

Review of the More Complex Model of Enrollment

In general, extending the simple theoretical model of the college enrollment decision to take into account more subtle but real factors affecting the associated benefits and costs suggests that the simple model understates the returns to a college degree and

overstates the ease of financing that degree. Differences in labor force participation rates, unemployment rates, and benefits levels by education suggest that wage differentials alone understate the return to a college degree. Progressive tax rates work in the opposite direction but are not likely progressive enough to dominate. The high unemployment rate of recent high school graduates, by reducing the opportunity cost of enrollment, also acts theoretically to increase enrollment. It would be of interest to learn more about the expectations potential students have regarding the benefits associated with a college degree in order to assess their accuracy and their role in the enrollment process.

Conversely, the simple theoretical model by assuming individuals are not credit constrained fails to capture the cost of enrolling for a substantial fraction of the population. The common practice of controlling for family income and parental education in enrollment studies reveals the importance of these costs. Despite efforts by the government and private institutions, college enrollment is not an equal opportunity endeavor. The research summarized here suggests a need for further analysis of how tuition, financial aid, and even the information and expectations potential applicants have about tuition and financial aid impact both college enrollment and the effort invested to prepare for college.

The more in-depth presentation here explains/justifies at least some of the substantial heterogeneity in enrollment outcomes observed across the population but has limited power to explain historic or forecast future enrollment. Ability differs over the population as does income and parental education. Ability has not really changed over time – this factor cannot explain past or predict future changes in enrollment. Income has risen which makes it easier overall to invest in college, though the growth in income inequality may curtail this advantage. Parental education has risen and likely has acted and will act to increase college enrollment in the future. Academic preparation is likely endogenously determined.

Economic conditions and policy factors appear to have greater explanatory power. High rates of unemployment lower the opportunity cost of going to college; the recent recession has likely increased enrollment. No one, however, is likely to promote economic recessions as a means of increasing educational attainment. Legislation making aid for higher education more readily available and more generous has been linked to increased enrollment in higher education, but with state and federal budgets still in deficit, future gains may be difficult to negotiate.

Dynamic Effects and Supply-Side Constraints

In the previous sections, factors influencing the decision to enroll were generally evaluated in a static rather than dynamic framework, supply was assumed to be perfectly elastic, and the probability of graduating was not addressed. A thorough discussion of these concerns is beyond the scope of this chapter. This section rather serves to whet the appetite than to provide a comprehensive literature review. Basically, changes in the college enrollment decision at the aggregate level may in

fact feed back to change the incentive to invest. These feedback effects typically act to moderate rather than amplify enrollment trends. In addition, changes in one factor may cause changes in other factors, making it difficult to identify the effect of each individual factor on enrollment. While the long-run supply of college seats may be quite elastic, short-run supply has limits that will impose constraints on college enrollment. Finally, enrollment does not equate to degree receipt and the path students take following matriculation deserves further attention.

As documented at the beginning of this chapter, the fraction of 25–29-year-olds with a bachelor's degree or more has tripled since 1960, with significant increases occurring between 1960 and 1980 and again in the later 1990s and around 2008. While the goal is to maintain our competitive edge in higher education, it is important to recognize how increasing educational attainment likely affects the enrollment decision of future potential students.

A greater supply of college educated persons in the face of a constant demand will, according to the basic economic model of supply and demand, decrease the "price" or wage received by college graduates. If a larger fraction of the population has a college degree, a smaller fraction must have only a high school degree. A smaller supply of high school educated individuals will in theory act to increase the "price" or wage received by high school graduates. The power of the supply–demand model to explain educational wage differentials over time has been well documented (see Card and Lemieux 2001; Goldin and Katz 2007b). The predicted effect in this case is that the opportunity cost of going to college increases (with an increase in the wage of high school workers) and the college wage premium decreases. Both of these wage effects will act to reduce the incentive to pursue a college degree. Thus, the effect of increased college enrollment, ceteris paribus with respect to demand conditions, will be to reduce the incentive of future cohorts to attend college.

College enrollment has increased a bit since 2007 (likely the effect of poor labor market conditions depressing opportunity costs), but overall college enrollment has been relatively flat while demand for more educated, technology competent workers has been rising (Goldin and Katz 2007a).[8] While feedback effects have a dampening influence upon the wage incentives for college enrollment, the current outlook is for the substantial current college wage premium to persist for some time, hopefully helping to stimulate enrollment.

Increased enrollment rates do not change the characteristics of the underlying population but do change the characteristics of the marginal student. Such changes can influence the enrollment probability of those on the margin and hence influence enrollment trends. Consider, for example, ability. If ability is normally distributed across the population and more able individuals are more likely to attend college (see Belley and Lochner 2007 for evidence), then an increase in enrollment rates is likely to be associated with a decrease in the average ability of college students. Hoxby (2009) finds exactly this result when she plots SAT/ACT scores by college selectivity. Student ability/college selectivity decreased at a majority of colleges

[8] By contrast, in looking at the impact of baby boomers' retirements, Neumark et al. (2013) report that a skill shortage is unlikely to occur in the next 5 years.

between 1962 and 2007 as enrollment increased. Student ability can in turn impact the value of several factors related to college enrollment. Less able students may take longer to earn a degree because they need to enroll in more remedial classes and cannot take as high a course load. Thus, the college wage differential may need to be higher to attract less able students to enroll in college. At the same time, earnings are likely themselves to be a function of ability and less able college students may earn a lower wage premium. Carneiro and Lee (2011) examine the impact of quality changes between 1960 and 2000 on the college wage premium. They estimate that the college wage premium would have been about six percentage points higher in 2000 had student quality remained constant. Quality must also have declined for high school graduates, but the wages of high school graduates seem less sensitive to quality. Juhn et al. (2005) also find evidence of declining quality for college graduates and a declining wage premium but write that these account for only a small fraction of the observed fluctuations in the premium. Thus, changes in enrollment rates can affect the college wage premium directly via supply/demand arguments or indirectly by altering the characteristics of students who enroll and so the factors that drive enrollment.

Several of the factors are also by their nature intertwined. One example is tuition charges and aid generosity. Another example is employment while enrolled and time to graduation.

A number of researchers have identified feedback links from aid policies to tuition charges. St. John (1994) discusses a Robin Hood strategy that he reports was commonly used by private colleges in the 1980s, whereby institutions increased list price tuition and used the increased revenue to finance more generous institution-provided student aid. Turner (2012) finds that increases in tax-based federal aid programs, particularly those directed at middle-income students, are to a substantial degree offset by reduced institutional grant aid at the more selective institutions he examines. Thus, at these institutions, the effect of federal tax-based aid will likely be underestimated when approached conventionally. Singell and Stone (2007) find that changes in the generosity of Pell grants are closely associated with tuition increases for all students at private colleges and for out-of-state students at public colleges, even controlling for institution-specific effects. Indeed, the magnitude of the effect indicates that as the generosity of Pell grants increases by $1, list price tuition increases by about $0.80. Long (2004) also finds evidence of such pass through looking at the HOPE scholarship program in Georgia. These studies highlight the importance of considering institutional pricing/aid policies and noninstitutional aid programs jointly. It is difficult to maintain the "ceteris paribus" assumption regarding changing aid generosity if aid is largely offset by tuition increases. Other sources of institutional funding also need to be considered. State funding for higher education has been cut substantially in the last decades, leading public institutions to increase their tuition charges. That these increases correspond with periods of increased federal aid generosity may be a spurious finding.

Employment necessarily takes time; so do classes and homework. The effect employment has on college students has been the subject of some debate. Kalenkoski and Pabilonia (2010) provide a brief literature review. Basically increased work

experience may increase wages (particularly if the job is in a field related to one's major – see Geel and Backes-Gellner 2011) or it may have a negative impact on the college experience. Kalenkoski and Pabilonia report evidence that increased employment hours reduce college GPA and hence potentially postcollege earnings. Bound et al. (2010a) argue that working longer hours while in school likely increases the time it takes to earn a college degree because it crowds out the time spent studying. Babcock and Marks (2011) use data from different sources (adjusted for sample design) to show that study time by college students decreased by 10 h per week between 1961 and 2003. Unfortunately, they lack the information necessary to identify the activities (such as employment) towards which students turned their attention. Increased time to degree increases the cost of a college degree, while decreased intensity and increased employment while enrolled reduces the cost of a college degree. It is again difficult to untangle these diverse effects.

Economic theory tells us that it is not only demand for a college degree that determines enrollment but also the ability to supply that degree. If demand increases without a consequent increase in the quantity supplied, enrollment will be unchanged and tuition higher. In an analysis of supply, Baird (2006) finds that state four-year and two-year college enrollment rates rise with state expenditures on education per 18–24-year-old (their measure of supply). Bound and Turner (2007) provide stronger evidence of supply-side constraints, finding that educational attainment is lower when state-year-specific college-aged cohorts are larger. Winters (2012) finds that large cohorts of resident students crowd out nonresident students and cause tuition increases for nonresident students at flagship universities. Bound et al. (2010a) report that degree receipt is lower for men at non-flagship state universities and at two-year institutions and that decreased institutional resources explain these changes better than individual characteristics (such as preparedness). Bound and Turner (2011) and Hoxby (2009) provide evidence that resources have been increasing at more selective institutions while barely holding their own at the rest.

Finally, the focus of this chapter has been upon enrollment rather than degree receipt. There is evidence that enrollment has been rising more rapidly than degree receipt, suggesting that not only has time to degree increased but that graduation rates are falling (Turner 2004). Many of the same factors influencing enrollment also influence success in higher education (see Tinto 1975 for a theoretical presentation on persistence and Kuh et al. 2006 for a recent review of success). Factors may, however, play a different role as students progress towards a degree (see, e.g., Ishitani 2003; DesJardins et al. 2002). In addition, the role of uncertainty (Altonji 1993) and new information (typically about ability as in Stinebrickner and Stinebrickner 2012) become critical, and there is evidence that school type and quality as well as student-institutional match play a role (see, e.g., Bean 1980; Melguizo 2008; Light and Strayer 2000). No one enrolls in college knowing they will not succeed, but students whose chance of succeeding is lower will be attracted by rising returns to a college degree. New information about ability and college costs is revealed to individuals over time. Changing economic conditions that change the opportunity cost associated with college and/or the benefits associated with rapid degree progress can also influence time to degree and the probability of

degree receipt (see Messer and Wolter 2010 for one such discussion). Controlling for full-time and part-time enrollment, stop-out and college transfer behavior further complicate the path analysis. The references listed here only scratch the surface of the existing literature regarding degree receipt.

Conclusion

In conclusion, the USA currently has one of the most highly educated populations in the world, but the younger generation is not any more educated than the older generation and a number of other countries are on target to overtake the USA. To maintain its competitive edge in the education field, the USA needs to enroll and graduate more college students. It must do so in the face of an increasing Hispanic population that has lower than average enrollment rates. The focus of this chapter has been upon identifying the factors that influence the enrollment decision both over time and across the population in order to better understand that decision and the factors that might be manipulated to increase enrollment. A simple version of the human capital model of college enrollment is presented and extended to relax many of the unrealistic assumptions embedded therein.

Research suggests that much of the past increase in college enrollment rates is attributable to increases in the college wage premium. For women, increased labor market participation has multiplied this effect. Policy efforts to provide aid to students whether from the GI Bill post-World War II or via Pell grants have also had an effect, recently muted by rapid increases in tuition rates, particularly at state institutions strapped for cash. Recessions, by reducing the opportunity cost of enrollment, tend to result in temporarily higher enrollment rates. Thus, the model does help explain some of the historic variation in enrollment.

Enrollment rates will only rise in the future if more individuals feel that the benefits of enrollment outweigh the costs of enrollment. Rising college wage premiums caused by rising demand for college educated workers should act to increase enrollment. The effect of this premium is magnified by the lower unemployment rate and higher nonwage benefits experienced by more educated persons. The availability of more universal health-care coverage and the possibility of higher marginal tax rates in the future will likely dampen, but not eliminate, these less recognized benefits to higher education over the coming years.

Evidence suggests that rising enrollment will also pull some less able students into colleges and lower the average return to a college education by increasing time to degree and lowering the college wage premium. However, this effect will be felt primarily by these less able students and if the benefits still outweigh the costs, it will still be in their best interest to enroll. Decreases in the opportunity cost of college such as the higher unemployment rate and lower earnings of young high school graduates during the 2007–2009 recession and the slow recovery following it will likely increase educational attainment in the near term but are hardly forces we would wish to persist. Decreases in the opportunity cost of college caused by

increasing employment among undergraduates, while potentially financing an increase in enrollment, also have possibly serious long-run disadvantages as regards college completion.

Probably the most serious impediment to higher educational attainment in the USA is the high and still rising direct cost of higher education in the USA, higher than the costs in any other OECD country (OECD 2011). Though the benefits associated with a higher education are lower elsewhere – in part because of more compressed wage structures – the costs are low enough when combined with rising returns to attract an increasing share of youth to pursue further study. As the clear majority of youth from high-income households in the USA are already enrolled in higher education, higher enrollment rates require attracting lower-income (and hopefully high-ability) students to attend. To the extent that today's parents are more educated than those 20 years ago and can perhaps help their children navigate the application and particularly the financial aid puzzle, such an increase is increasingly feasible. However, there is also ample evidence that less advantaged students often lack important information about the application process and have low expectations that reduce important precollegiate investments in education. While federal efforts to make college more affordable are currently widespread, state support has not kept pace with inflation. To the extent that increased financial aid is accompanied by higher tuition rates, college enrollment is unlikely to rise dramatically. Further research regarding the expectations students have regarding the costs and payoffs associated with enrollment, including the rate at which future benefits are discounted, and the impact of tuition rates and financial aid opportunities upon enrollment is necessary to identify effective policy to increase enrollment.

Furthermore, increases in college enrollment do not guarantee increases in college degree receipt, and there is evidence that graduation rates are at best stagnant. The path towards graduation is replete with obstacles and time to degree is rising for those who do complete, putting further pressure on the cost side. To increase educational attainment in the USA, enrollment costs need to be effectively addressed and further attention should be directed to the path taken. Higher returns to a college degree alone will not increase enrollment by youth from lower-income households facing imperfect capital markets that now constitute the largest target population.

Acknowledgements I would like to thank Robert Andrews, Terry Ishitani, Christine Keller, and Sarah Turner for their comments on an earlier draft. Any errors or omissions are, of course, my own responsibility.

References

Adelman, C. (1999). *Answers in the tool box: Academic intensity, attendance patterns, and bachelor's degree attainment*. Washington, DC: U.S. Department of Education.

Adelman, C. (2006). *The toolbox revisited: Paths to degree completion from high school through college*. Washington, DC: U.S. Department of Education.

Alm, J., & Winters, J. V. (2009). Distance and intrastate college student migration. *Economics of Education Review, 28*(6), 728–738.

Altonji, J. (1993). The demand for and return to education when education outcomes are uncertain. *Journal of Labor Economics, 11*(1), 48–83.

Andreoni, J., & Sprenger, C. (2012). Risk preferences are not time preferences. *American Economic Review, 102*(7), 3357–3376.

Andrews, R. J., Li, J., & Lovenheim, M. F. (2012). *Quantile treatment effects of college quality on earnings: Evidence from administrative data in Texas* (NBER Working Paper No. 18068).

Arcidiacono, P. (2004). Ability sorting and the returns to college major. *Journal of Econometrics, 121*(1–2), 343–375.

Autor, D. H., Katz, L. F., & Kearney, M. S. (2008). Trends in U.S. wage inequality: Revising the revisionists. *Review of Economics and Statistics, 90*(2), 300–323.

Avery, C., & Hoxby, C. M. (2004). Do and should financial aid packages affect students' college choices? In C. M. Hoxby (Ed.), *College choices: The economics of where to go, when to go, and how to pay for it*. Chicago: University of Chicago Press.

Betts, J. R. (1996). What do students know about wages? Evidence from a survey of undergraduates. *Journal of Human Resources, 31*(1), 27–56.

Babcock, P., & Marks, M. (2011). The falling time cost of college: Evidence from half a century of time use data. *Review of Economics and Statistics, 93*(2), 468–478.

Backes, B. (2012). Do affirmative action bans lower minority college enrollment and attainment? Evidence from statewide bans. *Journal of Human Resources, 47*(2), 436–455.

Baird, K. (2006). Access to college: The role of tuition, financial aid, scholastic preparation and college supply in public college enrollments. *NASFAA Journal of Student Financial Aid, 36*(3), 16–38.

Barrow, L., & Rouse, C. E. (2005). Do returns to schooling differ by race and ethnicity? *The American Economic Review Papers and Proceedings, 95*(2), 83–87.

Bean, J. P. (1980). Dropouts and turnover. The synthesis and test of a causal model of student attrition. *Research in Higher Education, 12*(2), 155–187.

Becker, G. (1975). *Human capital*. New York: National Bureau of Economic Research.

Behaghel, L., & Blau, D. M. (2012). Framing social security reform: Behavioral responses to changes in the full retirement age. *American Economic Journal: Economic Policy, 4*(4), 41–67.

Bell, D., & Marclay, W. (1987). Trends in retirement eligibility and pension benefits, 1974–83. *Monthly Labor Review, 110*(4), 18–25.

Belley, P., & Lochner, L. (2007). The changing role of family income and ability in determining educational achievement. *Journal of Human Capital, 1*(1), 37–89.

Bettinger, E., Long, B. T., Oreopoulos, P., & Sanbonmatsu, L. (2012). The role of application assistance and information in college decisions: Results from the H&R Block FAFSA experiment. *Quarterly Journal of Economics, 127*(3), 1205–1242.

Bifulco, R., Fletcher, J. M., & Ross, S. L. (2011). The effect of classmate characteristics on post-secondary outcomes: Evidence from the add health. *American Economic Journal: Economic Policy, 3*(1), 25–53.

Black, D. A., & Smith, J. A. (2004). How robust is the evidence on the effects of college quality? Evidence from matching. *Journal of Econometrics, 121*(1–2), 99–124.

Black, D. A., & Smith, J. A. (2006). Estimating the returns to college quality with multiple proxies for quality. *Journal of Labor Economics, 24*(3), 701–728.

Blau, D. M., & Gilleskie, D. B. (2008). The role of retiree health insurance in the employment behavior of older men. *International Economic Review, 49*(2), 475–514.

Blau, D. M., & Goodstein, R. M. (2010). Can Social Security explain trends in labor force participation of older men in the United States? *Journal of Human Resources, 45*(2), 328–363.

Bound, J., & Turner, S. (2002). Going to war and going to college: Did World War II and the G.I Bill increase educational attainment for returning veterans? *Journal of Labor Economics, 20*(4), 784–815.

Bound, J., & Turner, S. (2007). Cohort crowding: How resources affect collegiate attainment. *Journal of Public Economics, 91*(5–6), 877–899.

Bound, J., & Turner, S. (2011). Chapter 8: Dropouts and diplomas: The divergence in collegiate outcomes. In E. A. Hanushek, S. Machin, & L. Woessmann (Eds.), *Handbook of the economics of education* (Vol. 4). Amsterdam: Elsevier.

Bound, J., Lovenheim, M. F., & Turner, S. (2010a). *Increasing time to baccalaureate degree in the United States* (NBER Working Paper 15892).

Bound, J., Lovenheim, M. F., & Turner, S. (2010b). Why have college completion rates declined? An analysis of changing student preparation and collegiate resources. *American Economic Journal: Applied Economics, 2*(2), 129–157.

Bureau of the Census. (1975). *Historical statistics of the United States: Colonial times to 1970, Part I*. Retrieved from http://books.google.com/books?id=0YzOoHrvMPIC&pg=PA121&source=gbs_toc_r&cad=4#v=onepage&q&f=false

Bureau of the Census. (2012). *The 2012 statistical abstract of the United States*. Retrieved from http://www.census.gov/compendia/statab/. Accessed May 2013.

Cameron, S. V., & Heckman, J. J. (1998). Life cycle school and dynamic selection bias: Model and evidence for five cohorts of American males. *Journal of Political Economy, 106*(2), 262–333.

Cameron, S. V., & Heckman, J. J. (2001). The dynamics of educational attainment for Black, Hispanic, and White males. *Journal of Political Economy, 109*(3), 455–499.

Card, D., & Lemieux, T. (2001). Going to college to avoid the draft: The unintended legacy of the Vietnam War. *The American Economic Review, Papers and Proceedings, 91*(2), 97–102.

Carneiro, P., & Heckman, J. J. (2002). The evidence on credit constraints in post-secondary schooling. *The Economic Journal, 112*(482), 705–734.

Carneiro, P., & Lee, S. (2011). Trends in quality-adjusted skill premia in the United States, 1960–2000. *American Economic Review, 101*(6), 2309–2349.

Castillo, M., Ferraro, P., Jordan, J., & Petrie, R. (2011). The today and tomorrow of kids: Time preferences and educational outcomes of children. *Journal of Public Economics, 95*(11–12), 1377–1385.

Clark, D. (2011). Do recessions keep students in school? The impact of youth unemployment on enrolment in post-compulsory education in England. *Economica, 78*(311), 523–545.

College Board. (2012). *Trends in college pricing*. Retrieved from trends.collegeboard.org. Accessed June 2013.

Cragg, K. M. (2009). Influencing the probability for graduation at four-year institutions: A multi-model analysis. *Research in Higher Education, 50*(4), 394–413.

Croson, R., & Gneezy, U. (2009). Gender differences in preferences. *Journal of Economic Literature, 47*(2), 448–474.

Dale, S. B., & Krueger, A. B. (2002). Estimating the payoff to attending a more selective college: An application of selection on observables and unobservables. *The Quarterly Journal of Economics, 117*(4), 1491–1527.

Daun-Barnett, N. J. (2013). Access to college: A reconsideration of the National Education Longitudinal Study (NELS). *Educational Policy, 27*(1), 3–32.

DePaoli, B., & Zabczyk, P. (2012). Why do risk premia vary over time? A theoretical investigation under habit formation. *Macroeconomics Dynamics, 16*(Suppl. 2), 252–266.

DesJardins, S. L., Ahlburg, D. A., & McCall, B. P. (1999). An event history model of student departure. *Economics of Education Review, 18*(3), 375–390.

DesJardins, S. L., Ahlburg, D. A., & McCall, B. P. (2002). A temporal investigation of factors related to timely degree completion. *Journal of Higher Education, 73*(5), 555–582.

DesJardins, S. L., Ahlburg, D. A., & McCall, B. P. (2006). An integrated model of application, admission, enrollment, and financial aid. *Journal of Higher Education, 77*(3), 381–429.

Dohmen, T., Falk, A., Huffman, D., & Sunde, U. (2011a). The intergenerational transmission of risk and trust attitudes. *Review of Economic Studies, 79*(2), 645–677.

Dohmen, T., Falk, A., Huffman, D., Sunde, U., Schupp, J., & Wagner, G. G. (2011b). Individual risk attitudes: Measurement, determinants, and behavioral consequences. *Journal of the European Economic Association, 9*(3), 522–550.

Dougherty, C. (2005). Why are the returns to schooling higher for women than for men? *Journal of Human Resources, 40*(4), 969–988.

Duggan, M., Singleton, P., & Song, J. (2007). Aching to retire? The rise in the full retirement age and its impact on the Social Security disability rolls. *Journal of Public Economics, 91*(7–8), 1327–1350.

Dynarski, S. (2002). The behavioral and distributional implications of aid for college. *The American Economic Review, Papers and Proceedings, 92*(2), 279–286.

Dynarski, S. M. (2003). Does aid matter? Measuring the effect of student aid on college attendance and completion. *The American Economic Review, 93*(1), 279–288.

Eckel, C. C., Grossman, P. J., Johnson, C. A., De Oliveira, A. C. M., Rojas, C., & Wilson, R. K. (2012). School environment and risk preferences: Experimental evidence. *Journal of Risk and Uncertainty, 45*(3), 265–292.

Flores-Lagunes, A., & Light, A. (2010). Interpreting degree effects in the returns to education. *Journal of Human Resources, 45*(2), 439–467.

Foster, G. (2006). It's not your peers, and it's not your friends: Some progress toward understanding the educational peer effect mechanism. *Journal of Public Economics, 90*(8–9), 1455–1475.

Frenette, M. (2006). Too far to go on? Distance to school and university participation. *Education Economics, 14*(1), 31–58.

Friedberg, L., & Webb, A. (2005). Retirement and the evolution of pension structure. *Journal of Human Resources, 40*(2), 281–308.

Geel, R., & Backes-Gellner, U. (2011). Earning while learning: When and how student employment is beneficial. *Labour, 26*(3), 313–340.

Goldin, C. (1986). The female labor force and American economic growth, 1890–1980. In S. L. Engerman, & R. E. Gallman (Eds.), *Long-term factors in American economic growth* (pp. 557–604). Chicago: University of Chicago Press. Retrieved from http://www.nber.org/chapters/c9688.pdf. Accessed May 2013.

Goldin, C., & Katz, L. F. (2007a). Long-run changes in the wage structure: Narrowing, widening, polarizing. *Brookings Papers on Economic Activity, 2007a*(2), 135–165.

Goldin, C., & Katz, L. F. (2007b). *The race between education and technology: The evolution of U.S. educational wage differentials, 1890 to 2005* (NBER Working Paper No. 12984).

Goldin, C., Katz, L. F., & Kuziemko, I. (2006). The homecoming of American college women: The reversal of the college gender gap. *Journal of Economic Perspectives, 20*(4), 133–156.

Greenwood, J., Guner, N., Kocharkov, G., & Santos, C. (2012). *Technology and the changing family: A unified model of marriage, divorce, educational attainment and married female labor-force participation* (*NBER Working Paper No. 17735*).

Guiso, L., Sapienza, P., & Zingales, L. (2011). Time varying risk aversion. *Mimeo*.

Hanel, B., & Riphahn, R. T. (2012). The timing of retirement – New evidence from Swiss female workers. *Labour Economics, 19*(5), 718–728.

Harrison, G. W., Lau, M. I., & Williams, M. B. (2002). Estimating individual discount rates in Denmark: A field experiment. *The American Economic Review, 92*(5), 1606–1617.

Haveman, R., & Wolfe, B. (1995). The determinants of children's attainments: A review of methods and findings. *Journal of Economic Literature, 33*(4), 1829–1978.

Hinrichs, P. (2012). The effects of affirmative action bans on college enrollment, educational attainment, and the demographic composition of universities. *Review of Economics and Statistics, 94*(3), 712–722.

Hirsch, B., & Schnabel, C. (2012). Women move differently: Job separations and gender. *Journal of Labor Research, 33*(4), 417–442.

Hoekstra, M. (2009). The effect of attending the flagship state university on earnings: A discontinuity-based approach. *Review of Economics and Statistics, 91*(4), 717–724.

Horn, L., Cataldi, E. F., & Sikora, A. (2005). *Waiting to attend college: Undergraduates who delay their postsecondary enrollment* (NCES Report No. 2005–152).

Horowitz, A. W., Lee, J., & Trivitt, J. R. (2009). Household-level education borrowing constraints: Evidence using the college attendance of the sisters of Vietnam draft avoiders. *Journal of Human Capital, 3*(3), 197–223.

Hoxby, C. M. (2009). The changing selectivity of American colleges. *Journal of Economic Perspectives, 23*(4), 95–118.

Hoxby, C. M., & Avery, C. (2012). *The missing "one-offs": The hidden supply of high-achieving, low income students* (*NBER Working Paper No. 18586*).
Ishitani, T. T. (2003). A longitudinal approach to assessing attrition behavior among first-generation students: Time-varying effects of pre-college characteristics. *Research in Higher Education, 44*(4), 433–449.
Jaeger, D. A., & Page, M. E. (1996). Degrees matter: New evidence on sheepskin effects in the returns to education. *The Review of Economics and Statistics, 78*(4), 733–740.
Jepsen, C., & Montgomery, M. (2012). Back to school: An application of human capital theory for mature workers. *Economics of Education Review, 31*(1), 168–178.
Johnson, I. (2008). Enrollment, persistence and graduation of in-state students at a public research university: Does high school matter. *Research in Higher Education, 49*(8), 776–793.
Juhn, C., Kim, D. I., & Vella, F. (2005). The expansion of college education in the United States: Is there evidence of declining cohort quality? *Economic Inquiry, 43*(2), 303–315.
Kahn, L. B. (2010). The long-term labor market consequences of graduating from college in a bad economy. *Labour Economics, 17*(2), 303–316.
Kalenkoski, C. M., & Pabilonia, S. W. (2010). Parental transfers, student achievement, and the labor supply of college students. *Journal of Population Economics, 23*(2), 469–496.
Kane, T. J. (1994). College entry by Blacks since 1970: The role of college costs, family background, and the returns to education. *Journal of Political Economy, 102*(5), 878–911.
Kim, H., & DeVaney, S. A. (2005). The selection of partial or full retirement by older workers. *Journal of Family and Economic Issues, 26*(3), 371–394.
Kuh, G. D., Kinzie, J., Buckley, J. A., Bridges, B. K., & Hayek, J. C. (2006). *What matters to student success: A review of the literature*. Final report for the National Postsecondary Education Cooperative and National Center for Education Statistics. Bloomington: Indiana University Center for Postsecondary Research.
Light, A., & Strayer, W. (2000). Determinants of college completion: School quality or student ability? *The Journal of Human Resources, 35*(2), 299–332.
Lochner, L. J., & Monge-Naranjo, A. (2008). *The nature of credit constraints and human capital* (*NBER Working Paper No. 13912*).
Long, B. T. (2004). How do financial aid policies affect colleges? The institutional impact of the Georgia HOPE Scholarship. *Journal of Human Resources, 39*(4), 1045–1066.
Lovenheim, M. F. (2011). The effect of liquid housing wealth on college enrollment. *Journal of Labor Economics, 29*(4), 741–771.
Lovenheim, M. F., & Owens, E. G. (2013). *Does federal financial aid affect college enrollment? Evidence from drug offenders and the Higher Education Act of 1998* (NBER Working Paper No. 18749).
Lovenheim, M. F., & Reynolds, C. L. (2013). The effect of housing wealth on college choice: Evidence from the housing boom. *Journal of Human Resources, 48*(1), 1–35.
Lumina Foundation. (2013). *Annual report*. Retrieved from http://www.luminafoundation.org/publications/A_stronger_nation_through_higher_education-2013.pdf. Accessed 9 July 2013.
Lynch, L. M., & Black, S. E. (1998). Beyond the incidence of employer-provided training. *Industrial & Labor Relations Review, 52*(1), 64–81.
Macunovich, D. J. (2012). Older men: Pushed into retirement in the 1970s and 1980s by the baby boomers? *Monthly Labor Review, 135*(5), 3–18.
Manchester, J., & Song, J. (2011). What can we learn from analyzing historical data on Social Security entitlements? *Social Security Bulletin, 71*(4), 1–13.
Mare, R. D. (1991). Five decades of educational assortative mating. *American Sociological Review, 56*(1), 15–32.
Mastrobuoni, G. (2009). Labor supply effects of the recent Social Security benefit cuts: Empirical estimates using cohort discontinuities. *Journal of Public Economics, 93*(11–12), 1224–1233.
McPherson, M. S., & Schapiro, M. O. (1991). Does student aid affect college enrollment? New evidence on a persistent controversy. *American Economic Review, 81*(1), 309–318.
Melguizo, T. (2008). Quality matters: Assessing the impact of attending more selective institutions on college completion rates of minorities. *Research in Higher Education, 49*(3), 214–236.

Messer, D., & Wolter, S. C. (2010). Time-to-degree and the business cycle. *Economics Education, 18*(1), 111–123.
Mincer, J. (1974). *Schooling, experience, and earnings*. New York: Columbia University Press.
Mincer, J. (1991). *Education and unemployment* (NBER Working Paper No. 3838).
Mullis, I. V. S., Martin, M. O., Foy, P., & Drucker, K. T. (2012). *PIRLS 2011 international results in reading.* Chestnut Hill: TIMSS & PIRLS International Study Center, Boston College. Retrieved from http://timssandpirls.bc.edu/pirls2011/international-results-pirls.html. Accessed May 2013.
Munnell, A. H. (2011). *What is the average retirement age?* Center for Retirement Research at Boston College, Issue in Brief 11–11.
National Center for Education Statistics. (2012). *Digest of education statistics*. Washington, DC: Institute of Education Sciences. Retrieved from http://nces.ed.gov/programs/digest/2012menu_tables.asp. Accessed May 2013.
Neumark, D., Johnson, H., & Mejia, M. C. (2013). Future skill shortages in the U.S. Economy? *Economics of Education Review, 32*, 151–167.
OECD. (2011). *Education at a glance 2011: OECD indicators*. OECD Publishing. Retrieved from http://dx.doi.org/10.1787/eag-2011-en.
Oi, W. (1962). Labor as a quasi-fixed factor of production. *Journal of Political Economy, 70*(6), 538–555.
Paulsen, M. B., & Toutkoushian, R. K. (2008). Economic models and policy analysis in higher education: A diagrammatic exposition. In J. C. Smart (Ed.), *Higher education: Handbook of theory and research* (Vol. 23, pp. 1–48). Dordrecht: Springer.
Pérez-Peña, R. (2012, October 24). Report says college prices, once stable, are up again. *New York Times*. Retrieved from http://www.nytimes.com/2012/10/24/education/report-says-college-prices-once-stable-are-up-again.html. Accessed 31 May 2013.
Restuccia, D., & Vandenbroucke, G. (2013). A century of human capital and hours. *Economic Inquiry, 51*(3), 1849–1866.
Riddell, W. C., & Song, X. (2011). The impact of education on unemployment incidence and re-employment success: Evidence from the U.S. labour market. *Labour Economics, 18*(4), 453–463.
Ross, C. E., Masters, R. K., & Hummer, R. A. (2012). Education and the gender gaps in health and mortality. *Demography, 49*(4), 1157–1183.
Sacerdote, B. (2001). Peer effects with random assignment: Results for Dartmouth roommates. *The Quarterly Journal of Economics, 116*(2), 681–704.
Scott-Clayton, J. (2012). What explains trends in labor supply among U.S. undergraduates? *National Tax Journal, 65*(1), 181–210.
Seneca, J. J., & Taussig, M. K. (1987). The effects of tuition and financial aid on the enrollment decision at a state university. *Research in Higher Education, 26*(4), 337–362.
Singell, L. D., & Stone, J. A. (2007). For whom the Pell tolls: The response of university tuition to federal grants-in-aid. *Economics of Education Review, 26*(3), 285–295.
St. John, E. P. (1990). Price response in enrollment decisions: An analysis of the high school and beyond sophomore cohort. *Research in Higher Education, 31*(2), 161–176.
St. John, E. P. (1994). Assessing tuition and student aid strategies: Using price-response measures to simulate pricing alternatives. *Research in Higher Education, 35*(3), 301–334.
St. John, E. P., & Starkey, J. B. (1995). An alternative to net price: Assessing the influence of prices and subsidies on within-year persistence. *Journal of Higher Education, 66*(3), 156–186.
Staubli, S., & Zweimueller, J. (2011). *Does raising the retirement age increase employment of older workers?* (IZA Discussion Paper No. 5863).
Stinebrickner, T., & Stinebrickner, R. (2012). Learning about academic ability and the college dropout decision. *Journal of Labor Economics, 30*(4), 707–748.
Stinebrickner, R., & Stinebrickner, T. R. (2013). *A major in science? Initial beliefs and final outcomes for college major and dropout* (NBER Working Paper No. 19165).
Stratton, L. S., O'Toole, D. M., & Wetzel, J. N. (2008). A multinomial logit model of college attrition that distinguishes between stopout and dropout behavior. *Economics of Education Review, 27*(3), 319–331.

Thomas, S. L. (2000). Deferred costs and economic returns to college major, quality, and performance. *Research in Higher Education, 41*(3), 281–313.

Tinto, V. (1975). Dropout from higher education: A theoretical synthesis of recent research. *Review of Educational Research, 45*(1), 89–125.

Turner, S. E. (2004). Going to college and finishing college: Explaining different educational outcomes. In C. M. Hoxby (Ed.), *College choices: The economics of where to go, when to go, and how to pay for it*. Chicago: University of Chicago Press.

Turner, N. (2012). Who benefits from student aid? The economic incidence of tax-based federal student aid. *Economics of Education Review, 31*(4), 463–481.

U.S. Department of Labor, Bureau of Labor Statistics. (2011, December). *Women in the labor force: A databook* (Report 1034).

U.S. Department of Labor, Bureau of Labor Statistics. Retrieved from www.bls.gov. Accessed May–June 2013.

Venti, S. F., & Wise, D. A. (1982). Test scores, educational opportunities, and individual choice. *Journal of Public Economics, 18*(1), 35–63.

Willis, R. J., & Rosen, S. (1979). Education and self-selection. *Journal of Political Economy, 87*(5), S7–S36.

Winters, J. V. (2012). Cohort crowding and nonresident college enrollment. *Economics of Education Review, 31*(3), 30–40.

Wolman, L. (1938). Hours of work in American industry. In L. Wolman (Ed.), *Hours of work in American industry*. NBER. Retrieved from http://www.nber.org/chapters/c4124. Accessed June 2013.