Human Capital Policy

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Introduction and Motivation

Introduction

The aphorism that the source of a nation's wealth is the skill of its people has special meaning for contemporary American society. Growth in the quality of the U.S. workforce has been a major source of productivity growth and economic mobility over the past century. By many measures, since 1980 the quality of the U.S. workforce has stagnated, or its growth has slowed down dramatically (see Ellwood 2001; Jorgenson and Ho 1999; DeLong, Goldin, and Katz 2002).[1] Figure 2.1 shows that after a half century of progress, cohorts born after 1950 did not improve much, or at all, on the educational attainment of their predecessors. This is true for Americans of all racial and ethnic backgrounds. Moreover, the stagnation in educational attainment in the aggregate is not due solely to migration. Although immigrants in general are more unskilled than the remainder of the workforce and contribute to growth in the pool of unskilled labor, stagnation in aggregate college participation is also found among native-born Americans, although immigrants do contribute to the growing pool of high school dropouts (figure 2.2).

Unpleasant as these numbers are, the official statistics paint an overly optimistic picture because they count those who have exam-certified high school equivalents (i.e. General Educational Development or "GED") as high school graduates. According to these statistics the high school graduation rate is increasing and the high school dropout rate decreasing (see Figure 2.3a). Recent studies (Cameron and Heckman 1993; Boesel, Alsalam, and Smith 1998; and Heckman, Hsee, and Rubinstein 2001) show that those with GEDs perform the same in the labor market as high school dropouts with comparable schooling

levels. The percentage of measured high school graduates who receive the status by route of the GED is growing and is as high as 25 percent in some states (see figure 2.3b). As a result, the quality of measured high school graduates is declining. When GEDs are classified as dropouts, the U.S. high school dropout rate is increasing, and not decreasing as the official statistics indicate (see figure 2.3c).

The slowdown in the growth of the quality of the U.S. labor force comes in a period of increasing wage differentials between skilled and unskilled workers and contributes to the growth in those differentials and to overall wage inequality. The measured wage premium for higher-skilled workers began to increase substantially around 1980 (see Autor and Katz 1999). In response to the economic incentives provided by the increase in the wage premium, children from certain socioeconomic groups increased their college attendance in the 1980s. This response has not been uniform across racial, ethnic, or family income groups, however, even though the return to schooling has increased for all groups. Adolescent white male high school graduates from the top half of the family income distribution began to increase their college attendance rate in 1980 (see figure 2.4). Those from the third quartile of the family income distribution were less likely to attend college than those from the top half, and delayed their response to the rising wage premium for skill. The response to the wage premium was even more delayed for white male high school graduates at the bottom of the family income distribution. Thus already substantial gaps in college attendance among those from different income groups widened. Racial and ethnic gaps in attendance also widened (see figure 2.5).[2] Because education is a primary determinant of earnings, these differential responses to the increased market demand for skills will widen racial, ethnic, and family-origin wage differentials in the next generation, making the America of tomorrow even more unequal than the America of today and the America of the past.

In the face of declining real wages for low-skilled workers and increasing real returns

to college graduation, a greater proportion of U.S. youth are low-skilled dropouts than thirty years ago. College enrollment responses to the increasing return to schooling have been weak. This is in spite of the growth in per pupil expenditure in public schools over the past thirty years. Together with the decline in high school graduation has come a decline in the academic performance of American students (Hanushek 2000). America has an underclass of unskilled and illiterate persons with no counterpart in northern Europe (see Blau and Khan 2001).

The problem is clear. The supply of skilled workers is not keeping pace with demand. How to increase the supply of skilled workers in an economically efficient way is not so clear, and there are many advocates of fundamentally different policies that are difficult to compare because their costs and benefits have not been tabulated. Many recent discussions seize upon the gaps in schooling attainment by family income, evident in figure 2.4, as a major causal factor in the failure of the supply of skilled workers to increase. The growth in college tuition costs over the past twenty years and the decline in the earnings of families headed by low-skilled workers are often cited to explain college attendance patterns of their children (see Carnevale and Fry 2000, and Hauser 1993). Policies are proposed to reduce tuition or supplement family resources of children in the college-going years. Yet the evidence presented in this chapter suggests that longer-term factors such as parental environments and family income available to children over their entire life cycle are far more decisive in promoting college readiness and social attachment than family income in the adolescent years. This evidence suggests that factors operating during the early childhood years and culminating in adolescence in the form of crystallized cognitive abilities, attitudes, and social skills play far more important roles than tuition or family credit constraints during the college-going years in explaining minority-majority gaps in socioeconomic attainment. It suggests that tuition reduction may be much less effective in increasing college attendance

rates than policies that foster cognitive abilities.

In this chapter we critically examine the claim that liquidity constraints in the college-going years play a fundamental role in explaining the gaps in college attendance evident in figure 2.4. We present evidence that a small group of people is credit-constrained in this short-run sense, and that policies that relieve the constraints this group faces may be cost effective. Nonetheless, according to our analysis, relieving all short-term credit constraints is unlikely to reduce gaps in schooling participation substantially.

We also suggest a variety of other policies to improve the quality of skills in the American economy. Policies to improve the quality of secondary schools are often put forward, and debates over such policies are intense. We argue that such policies are unlikely to have any substantial effect on the quality of the U.S. workforce unless more fundamental reforms in incentives in schools are made. Second-chance remediation programs such as publicly provided job training or exam certification as an alternative to conventional high school graduation (GED programs) are sometimes suggested as effective low-cost strategies to overcome early disadvantage. We show that the economic return to such programs is low. Tax and subsidy policies are also advocated to address early disadvantage. We find that such policies are likely to have only modest effects on skill formation. Policies to limit the immigration of the unskilled are also proposed to alleviate downward pressure on wages and to reduce inequality (Borjas 1999). We argue that such policies are likely to be ineffective.

There is no shortage of policy proposals. There is, however, a shortage of empirical evidence on the efficacy of the policies proposed. No common framework has been used to evaluate them or compare them. The goal of this chapter is to provide evidence on the effectiveness of alternative policies within a common cost-benefit framework.

This chapter analyzes policies that are designed to foster skill formation in the American economy. A central premise of this chapter is that effective policy is based on

empirically grounded studies of the sources of the problems that the proposed policies are intended to address. Although it is possible through trial and error to stumble onto effective policies without understanding the sources of the problems that motivate them, a more promising approach to human capital policy formulation is to understand the mechanisms and institutions that produce skill, how they are related, and where they have failed.

Human capital accumulation is a dynamic process. The skills acquired in one stage of the life cycle affect both the initial conditions and the technology of learning at the next stage. Human capital is produced over the life cycle by families, schools, and firms, although most discussions of skill formation focus on schools as the major producer of abilities and skills, despite a substantial body of evidence that families and firms are also major producers of abilities and skills.

A major determinant of successful schools is successful families. Schools work with what parents bring them. They operate more effectively if parents reinforce them by encouraging and motivating children. Job training programs, whether public or private, work with what families and schools supply them and cannot remedy twenty years of neglect.

Recent studies in child development (e.g. Shonkoff and Phillips 2000) emphasize that different stages of the life cycle are critical to the formation of different types of abilities. When the opportunities for formation of these abilities are missed, remediation is costly, and full remediation is often prohibitively costly. These findings highlight the need to take a comprehensive view of skill formation over the life cycle that is grounded in the best science and economics so that effective policies for increasing the low level of skills in the workforce can be devised.

A study of human capital policy grounded in economic and scientific fundamentals improves on a purely empirical approach to policy evaluation that relies on evaluations of the programs and policies in place or previously experienced. Although any trustworthy study of

economic policy must be grounded in data, it is also important to recognize that the policies that can be evaluated empirically are only a small subset of the policies that might be tried. If we base speculation about economic policies on economic fundamentals, rather than solely on estimated "treatment effects" that are only weakly related to economic fundamentals, we are in a better position to think beyond what has been tried to propose more innovative solutions to human capital problems. This chapter investigates the study of human capital policy by placing it in the context of economic models of life cycle learning and skill accumulation rather than focusing exclusively on which policies have "worked" in the past.

We use the rate of return, in cases where it is justified, to place different policies on a common footing. Our justification for using the marginal rate of return to human capital compared to the market return on physical capital in evaluating human capital projects is presented in appendix A. For many, but not all, human capital policies, the marginal rate of return is an accurate guide to determining where the next dollar should be spent. We also compute present values of alternative policies where possible. Present values are not subject to the criticisms that are directed toward rates of return.

Figure 2.6 summarizes the major theme of this chapter. It plots the rate of return to human capital at different stages of the life cycle for a person of given abilities. The horizontal axis represents age, which is a surrogate for the agent's position in the life cycle. The vertical axis represents the rate of return to investment assuming the same investment is made at each age. *Ceteris paribus* the rate of return to a dollar of investment made while a person is young is higher than the rate of return to the same dollar made at a later age. Early investments are harvested over a longer horizon than those made later in the life cycle. In addition, because early investments raise the productivity (lower the costs) of later investments, human capital is synergistic. This dynamic complementarity in human investment was ignored in the early work on human capital (Becker 1964).[3] Learning begets

learning; skills (both cognitive and noncognitive) acquired early on facilitate later learning. For an externally specified opportunity cost of funds r (represented by the horizontal line with intercept r in figure 2.6a), an optimal investment strategy is to invest less in the old and more in the young. Figure 2.6b presents the optimal investment quantity counterpart of figure 2.6a.

We also develop a second interpretation of figure 2.6a in this chapter: that it is an empirical description of the economic returns to investment at current levels of spending in the American economy. The return to investment in the young is apparently quite high; the return to investments in the old and less able is quite low. A socially optimal investment strategy would equate returns across all investment levels. A central empirical conclusion of this chapter is that at *current* investment levels, efficiency in public spending would be enhanced if human capital investment were directed more toward the young and away from older, less-skilled, and illiterate persons for whom human capital is a poor investment.

Our analysis challenges the conventional point of view that equates skill with intelligence and draws on a body of research that demonstrates the importance of both cognitive and noncognitive skills in determining socioeconomic success. Both types of skills are affected by families and schools, but they differ in their malleability over the life cycle, with noncognitive skills being more malleable than cognitive skills at later ages. Differences in levels of cognitive and noncognitive skills by family income and family background emerge early and persist. If anything, schooling widens these early differences.

Current educational policy and economic analysis focuses on tested academic achievement as the major output of schools. Proposed systems for evaluating school performance are often premised on this idea. Economic models of signaling and screening assume that *predetermined* cognitive ability is an important determinant, if not *the* most important determinant, of academic and economic success. Recent evidence challenges this

view. No doubt, cognitive ability is an important factor in schooling and labor market outcomes. At the same time, noncognitive abilities, although harder to measure, also play an important role.

Noncognitive abilities matter for success both in the labor market and in schooling. This finding is supported by studies of early childhood interventions that primarily improve noncognitive skills, with substantial effects on schooling and labor market outcomes, but only weakly affect cognitive ability. Mentoring programs in the early teenage years can also affect these skills. Current analyses of skill formation focus too much on cognitive ability and too little on noncognitive ability in evaluating human capital interventions.

We also depart from the conventional human capital literature in another respect. The early literature stressed that human capital theory was an alternative to ability-based models of earnings. In our analysis, while cognitive ability is affected by schooling and family background, schooling does not equalize differences in cognitive ability. Cognitive ability is thus a form of human capital and not a rival to it.

This chapter also stresses the need for clear analytical frameworks for comparing alternative policies. Good economic policy evaluation accounts for the limited size of the government budget and the opportunity costs of public funds. Saying that an educational project earns a 10 percent rate of return and should be supported is a meaningless statement unless the opportunities forgone, including the other projects that could have been funded and the costs of tax revenues, are properly accounted for. We emphasize the importance of cost-benefit analyses that properly account for the full costs of policies, including the social-opportunity costs of funds for public projects. Many analyses of human capital programs ignore direct costs and the costs of taxation in presenting cost-benefit calculations. When these costs are counted properly, many apparently successful policies are shown to be economically unprofitable.

It is important to account for policies in place when one is evaluating new policies that are introduced to supplement existing efforts. One should distinguish statements about a world in which there is no human capital policy from the world in which we live. The relevant question for this chapter is whether we should increase current subsidies to education and job training, and not whether there should be any subsidies at all. At a very low level of expenditure, increasing schooling quality is known to improve schooling outcomes. Increasing the level of schooling undoubtedly produces externalities when schooling is at a low level. The current subsidy of direct costs to students at major public universities in the U.S. is around 80 percent, however, and the rate of subsidization is even higher for secondary and primary schools. The scope for the argument is correspondingly reduced.

One topic we do not discuss is the case for subsidies arising from human capital externalities. Although such externalities have received prominent play in the recent revival of growth theory, no evidence for them at *the current level of spending* has been found. An accumulating body of evidence (e.g., Acemoglu and Angrist 2001; Heckman, Layne-Farrar, and Todd 1996; Heckman and Klenow 1998) suggests that these theoretical possibilities are empirically irrelevant.

This chapter is organized in four parts, of which this introduction is the first. The second part lays the foundation for our policy analysis by examining the sources of skill disparities. A major premise of our chapter is that good policy is based on a clear understanding of the problems that policies are intended to address. We seek to elevate the discussion of skill formation policy above the level of the standard treatment effect approach that discusses what "works" and what does not. In the first section of this part, we present evidence on the relative importance of short-term credit constraints and cognitive ability in accounting for disparities in educational attainment (evidence on job training is presented in the third part). In the second section, we present evidence on the early origin of cognitive-

ability differentials and their determinants. In the third section, we present a similar analysis of noncognitive skills.

This chapter's third part draws on the analysis of the second part and discusses specific policies. The first section of this part discusses policies designed to improve primary and secondary schooling. We demonstrate the ineffectiveness of policies designed to improve schooling quality at existing levels of expenditure without reforms in incentives and choices in schools. Such policies are ineffective in terms of a cost-benefit analysis. The second section discusses the evidence on early childhood policies. The greatest effect of early childhood programs is on noncognitive skills, motivation and achievement, not on IQ. The third section discusses adolescent mentoring policies. We know that adolescent-mentoring programs are effective and operate primarily through motivation of participants. The fourth section discusses the evidence on the effectiveness of both public and private job training programs. Although some public job training programs are successful, most are not. The ones that are successful provide classroom education. Private training is much more successful. We present evidence that private training reinforces early differentials in ability and schooling but compensates for early disadvantages in access to funds. This latter feature of private training tends to offset the dynamic complementarity of the former feature. On net, job training is neutral with respect to family background. The fifth section discusses tax and subsidy policy. Tax policy is an unlikely vehicle for eliminating skill differentials. The sixth section discusses the problem of the transition and the likely effectiveness of wage subsidies. The seventh section briefly discusses migration policy. The separation of topics into the paper's second and third parts is far from exact. Some of the evidence on the skill formation process is obtained from analyzing specific policies. This chapter's fourth part concludes. We then present two appendices; one discusses rates of return and discount rates and the other complements the computations reported in part 2.

Sources of Skill Differences

The Evidence on Credit Constraints

There is a strong relationship between family income and college attendance. Figure 2.4 displays aggregate time series college participation rates for eighteen to twenty-four year old American males classified by their parental income, as measured in the child's late adolescent years. There are substantial differences in college participation rates across family income classes in each year. This pattern is found in many other countries (see the essays in Blossfeld and Shavit 1993). In the late 1970s or early 1980s, college participation rates start to increase in response to increasing returns to schooling, but only for youth from the top family income groups. This differential educational response by income class promises to perpetuate or widen income inequality across generations and among racial and ethnic groups.

There are two not necessarily mutually exclusive interpretations of this evidence. The common interpretation of the evidence, and the one that guides current policy, is the obvious one. Credit constraints facing families in a child's adolescent years affect the resources required to finance a college education. A second interpretation emphasizes more long-run factors associated with higher family income. It notes that family income is strongly correlated over the child's life cycle. Families with high income in a child's adolescent years are more likely to have high income throughout the child's life at home. Better family resources in a child's formative years are associated with higher quality of education and better environments that foster cognitive and noncognitive skills.

Both interpretations of the evidence are consistent with a form of credit constraint. The first, more common interpretation is clearly consistent with this point of view. But the second interpretation is consistent with another type of credit constraint: the inability of the child to buy the parental environment and genes that form the cognitive and noncognitive

abilities required for success in school. This interpretation renders a market failure as a type of credit constraint.[4]

This chapter argues on quantitative grounds that the second interpretation of figure 2.4 is by far the more important one. Controlling for ability formed by the early teenage years, parental income plays only a minor role. The evidence from the U.S. presented in this chapter suggests that at most 8 percent of American youth are subject to short-term liquidity constraints that affect their postsecondary schooling. Most of the family income gap in enrollment is due to long-term factors that produce the abilities needed to benefit from participation in college.

In this section, we first summarize the evidence against an influential argument advanced by Card (1999, 2001) and others. That argument claims that the evidence that instrumental variables (IV) estimates of the wage returns to schooling (the Mincer coefficient) exceed ordinary least squares (OLS) estimates is evidence of the importance of short-term credit constraints. We discuss why this argument is uninformative about the presence or absence of short-term credit constraints in explaining educational attainment differentials or skill deficits.

We also consider a number of other arguments advanced in the literature in support of the empirical importance of short-term credit constraints.

- Kane (1994) claims that college enrollment is more sensitive to tuition for people from poorer families. Greater tuition sensitivity of the poor, even if empirically true, does not prove that they are constrained. Kane's empirical evidence has been challenged by Cameron and Heckman (1999, 2001). Conditioning on ability, responses to tuition are uniform across income groups.
- Cameron and Heckman also show that adjusting for long-term family factors (measured by ability or parental background) mostly eliminates ethnic or racial gaps

in schooling. We extend Cameron and Heckman's analysis and eliminate most of the family income gaps in enrollment by conditioning on long-term factors.

- We also examine a recent qualification of the Cameron and Heckman analysis by Ellwood and Kane (2000), who claim to produce evidence of substantial credit constraints. For several dimensions of college attendance, adjusting for long-term factors in their type of analysis eliminates any role for short-term credit constraints associated with family income.
- We also scrutinize the arguments advanced in support of short-term credit constraints that (a) the rate of return to human capital is higher than that to physical capital and (b) rates of return to education are higher for individuals from low-income families or for individuals with low ability.

The evidence assembled in this section suggests that the first-order explanation for gaps in enrollment in college by family income is long-run family factors that are crystallized in ability. Short-run income constraints do play a role in creating these gaps, albeit a quantitatively minor one. There is scope for intervention to alleviate these short-term constraints, but one should not expect to reduce the enrollment gaps in figure 2.4 substantially by eliminating such constraints.

Family Income and Enrollment in College

The argument that short-term family credit constraints are the most plausible explanation for the relationship depicted in figure 2.4 starts by noting that human capital is different from physical capital. With the abolition of slavery and indentured servitude, there is no asset market for human capital. People cannot sell rights to their future labor earnings to potential lenders to secure financing for their human capital investments. Even if they could, there

would be substantial problems in enforcing performance of contracts on future earnings given that persons control their own labor supply and the effort and quality of their work. The lack of collateral on the part of borrowers and the inability to monitor effort by lenders are widely cited reasons for current large-scale government interventions to finance education.

If people had to rely on their own resources to finance all of their schooling costs, undoubtedly the level of educational attainment in society would decline. To the extent that subsidies do not cover the full costs of college tuition, persons are forced to raise funds to pay tuition through private loans, through work while in college, or through foregone consumption. This may affect the choice of college quality, the content of the educational experience, the decision of when to enter college, the length of time it takes to complete schooling, and even graduation from college. Children from families with higher incomes have access to resources that are not available to children from low-income families, although children from higher-income families still depend on the good will of their parents to gain access to those resources. Limited access to credit markets means that the costs of funds are higher for the children of the poor, and this limits their enrollment in college.[5] This view apparently explains the evidence that shows that the enrollment response to the rising educational premium that began in the late 1970s or early 1980s was concentrated in the top half of the family income distribution. Low-income whites and minorities began to respond to the rise in the return to college education only in the 1990s. The reduction in the real incomes of parents in the bottom half of the family income distribution, coupled with a growth in real tuition costs, apparently contributes to growing disparity between the college attendance of the children of the rich and of the poor.

An alternative interpretation of the same evidence is that long-run family and environmental factors play a decisive role in shaping the ability and expectations of children. Families with higher levels of resources produce higher-quality children who are better able

to perform in school and take advantage of the new market for skills.

Children whose parents have higher incomes have access to better-quality primary and secondary schools. Children's tastes for education and their expectations about their life chances are shaped by those of their parents. Educated parents are better able to develop scholastic aptitude in their children by assisting and directing their studies. It is known that cognitive ability is formed relatively early in life and becomes less malleable as children age. By age 14 (some would say age 8), intelligence as measured by IQ tests seems to be fairly well set (see the evidence summarized in Heckman 1995). Noncognitive skills appear to be more malleable until the late adolescent years (Heckman 2000). The influences of family factors present from birth through adolescence accumulate to produce ability and college readiness. By the time individuals finish high school and their scholastic ability is determined, the scope of tuition policy for promoting college attendance through boosting cognitive and noncognitive skills is greatly diminished.

The interpretation that stresses the role of family and the environment does not necessarily rule out short-term borrowing constraints as a partial explanation for the patterns revealed in figure 2.4. However, if the finances of poor but motivated families hinder them from providing decent elementary and secondary schooling for their children, and produce a low level of college readiness, government policy aimed at reducing the short-term borrowing constraints for the college expenses of those children during their college-going years is unlikely to be effective in substantially closing the gaps in figure 2.4. In such circumstances, policy that improves the environments that shape ability will be more effective in increasing college enrollment in the long run. The issue can be settled empirically. Surprisingly, until recently there have been few empirical investigations of this topic.

The following experiment captures the essence of the distinction we are making.

Suppose families participate in lotteries that are adjusted to have the same expected present value (at age zero of the child) but have different award dates. Credit markets are assumed to be imperfect, at least in part, so the timing of receipts matters. A family that wins the lottery in the child's adolescent years is compared to a family that wins in the child's early formative years. The child from the family that wins late would lack all of the benefits of investment in the early years of the child that the child from the family that wins early would receive. The child from the late-winning family would be likely to have lower levels of cognitive and noncognitive abilities than the child from the early-winning family. Although none of the data we possess are as clean as the data generated by this hypothetical experiment, taken as a whole they point in the general predicted direction.

In this subsection, we critically examine the evidence in the literature and present new arguments and evidence of our own. Evidence exists for both short-run and long-run credit constraints. Long-run family influence factors produce both cognitive and noncognitive abilities that vitally affect schooling. Differences in levels of these skills among children emerge early and, if anything, are strengthened in school. Conditioning on long-term factors eliminates, for all except for a small fraction of young people, most of the effect of family income in the adolescent years on college enrollment decisions. We reach similar conclusions about other dimensions of college participation: delay of entry, final graduation, length of time to complete school, and college quality. For some of these dimensions, adjusting for long-run factors eliminates or even over-adjusts for family income gaps. At most, 8 percent of American youth are constrained in the short-run sense. Credit constraints in the late adolescent years play a role for a small group of youth who can be targeted.

Before turning to our main evidence, we briefly review and criticize the argument that comparisons between IV and OLS estimates of the returns to schooling are informative about the importance of credit constraints.

OLS, IV, and Evidence On Credit-Constrained Schooling

A large body of literature devoted to the estimation of "causal" effects of schooling has found that in many applications, instrumental-variables (IV) estimates of the return to schooling exceed ordinary-least-squares estimates (see Griliches 1977; Card 1999, 2001). Researchers have used compulsory-schooling laws, distance to the nearest college, and tuition as their instruments to estimate the return to schooling.

Since IV can be interpreted as estimating the return to schooling for those induced by the selected instrument to change their schooling status, finding higher returns for changers suggests that they are credit-constrained persons who face higher marginal costs of schooling. This argument has become very popular in recent research in the economics of education (see, e.g., Kane 2001; DeLong, Goldin and Katz 2002).

For three reasons, this evidence is not convincing on the issue of the existence of credit constraints. First, the validity of the instruments used in this literature is questionable (Carneiro and Heckman 2002). These instruments systematically bias upward the estimated return to schooling. Second, even granting the validity of the instruments, the IV-OLS evidence is consistent with empirically well-established models of self-selection or comparative advantage in the labor market even in the absence of credit constraints (Carneiro, Heckman, and Vytlacil 2001; Carneiro and Heckman 2002). Third, the argument ignores the quality margin. One manifestation of credit constraints is lower-quality schooling. Students will attend two-year schools instead of four-year school, or will attend lower-quality schools at any level of attained years of schooling. This leads to a *lower* Mincer return to credit-constrained people induced to attend college. For further elaboration of these arguments, see Carneiro and Heckman (2002).

An additional criticism of this literature is that, in general, IV does not identify the credit-constrained people for whom it would be useful to target an intervention. Using a direct method like the one described next, we can identify a group of high-ability people who are not going to college, and we can target policy interventions toward them.

Adjusting Family Income Gaps using Ability or Other Long-Term Family Factors

A more direct approach to testing the relative importance of long-run factors versus short-run credit constraints in accounting for the evidence in figure 2.4 is to condition on long-run factors and examine if there is any additional role for short-run credit constraints. Conditioning on observables also offers the promise of identifying specific subgroups of persons who might be constrained and who might be targeted advantageously by policies.

Cameron and Heckman (1998, 1999, 2001) compare the estimated effects of family background and family income on college attendance, controlling for scholastic ability (as measured by the Armed Forces Qualifying Test, or AFQT). Measured scholastic ability is influenced by long-term family and environmental factors, which are in turn produced by the long-term permanent income of families. To the extent that the influence of family income on college attendance is diminished by the inclusion of scholastic ability in an analysis of college attendance, one would conclude that long-run family factors crystallized in AFQT scores are the driving force behind schooling attainment, and not short-term credit constraints. Fitting a life cycle model of schooling to a subsample of the National Longitudinal Survey of Youth (NLSY) data with AFQT measured before high school graduation, Cameron and Heckman examine what portion of the gap between minority youth and whites in school attendance at various levels is due to family income, to tuition costs, and to family background.[6] They find that when they do not control for ability measured at an

early age, about half (five points) of the eleven-point gap between black and white college attendance rates is due to family income; more than half (four points) of the seven-point difference between Hispanics and whites is due to family income. When scholastic ability is accounted for, only one half of one point of the eleven-point black-white gap is explained by family income. The gap between Hispanics and whites actually widens when family income is included in the empirical model. Equalizing ability more than accounts for minority-majority college attendance gaps. Cameron and Heckman obtain comparable results when they adjust for parental education and family structure.[7] The effects of tuition on college entry are also greatly weakened when measures of ability are included. Ability and not financial resources in the teenage years accounts for pronounced minority-majority differences in schooling attainment. The disincentive effects of college tuition on college attendance are dramatically weakened when ability is included in the analysis of college attendance. This analysis suggests that it is long-run factors that determine college attendance, not short-term borrowing constraints, that explain the evidence in figure 2.4.

It is sometimes claimed that the enrollment responses to tuition should be larger for constrained (low-income) persons (see Kane 1994 and the survey in Ellwood and Kane 2000). This does not follow from any rigorous argument.[8] Table 2.1, taken from Cameron and Heckman 1999, explicitly addresses this issue empirically. It reports estimates of tuition responses by family income in the adolescent years of the child, not adjusting and adjusting for AFQT (see panels B and C of the table, respectively).[9] Even without adjusting for AFQT, there is no pattern in the estimated tuition response by family income level. When the authors condition on ability, tuition effects become smaller (in absolute value), and no pattern according to family income is apparent. Even if the argument that enrollment responses to tuition should be larger for those with low incomes had theoretical validity, there is no empirical support for it.

Ellwood and Kane (2000) accept Cameron and Heckman's main point, that academic ability is a major determinant of college entry. At the same time, they argue that family income operates as an additional constraint, not as powerful as academic ability, but more easily addressed by policy than ability. The left-hand portion of figures 2.7 and 2.8 present our version of Ellwood and Kane's case using data from the NLSY for 1979. Classifying people by ability results in a clear ordering that shows that more able people are more likely to go to college than those who are less able. Classifying white males by their test score terciles, we further display college enrollment rates by family income. There is a clear ordering in the high-ability group and in other ability groups as well. Persons from families with higher income are more likely to enroll in college. This ordering occurs in other data sets, even for low-ability groups.

The graphs on the left-hand side of figure 2.7 indicate a subsidiary, but still quantitatively important role for family income in accounting for schooling enrollment. This does not necessarily mean that short-run credit constraints are operative in the college-going years. Family income in the adolescent years is strongly correlated with family income throughout the life cycle. In addition, long-run family resources are likely to produce many skills that are not fully captured by a single test score.

When we control for early family background factors (parental education, family structure, and place of residence), we greatly weaken the relationship between family income and school enrollment. Tables 2.2A and 2.2B report overall adjusted gaps for the five measures of college participation listed in the table's first column. For each measure, within each AFQT tercile and income quartile, we adjust the raw rates for the background variables listed in the note to the table. Plots of the adjusted rates for three of these measures are presented in figures 2.7b, 2.7d, and 2.7f, corresponding to figures 2.7a, 2.7c, and 2.7e, respectively. The estimates in table 2.2 are weighted averages of the differences in adjusted

rates of enrollment, completion, and delay for each income quartile with respect to the highest income quartiles within each ability tercile averaged over all three ability terciles.[10] The weights used are the population proportion in each cell. The numbers reported in each table are measures of the adjusted discrepancy in participation rates by income, controlling for long-term factors, and are an estimate of the importance of short-term credit constraints. Focusing on enrollment in college (first row), as does most of the literature, we find that by this measure only 5.15 percent of all white males are constrained relative to the top income group. Figure 2.7b plots the adjusted family income gaps according to the three different ability terciles for college enrollment using the regressors reported in table 2.2a. Table 2.2b reports the results for the statistically significant gaps alone.[11] They are generally much smaller.

Most of the analysis in the literature focuses on college enrollment and much less on other dimensions of college attendance, such as completion, quality of school, and delay of entry into college.[12] In part, this emphasis on enrollment is due to reliance on Current Population Survey data, which are much more reliable for studying enrollment-family income relationships than for studying completion-family income relationships.

Using the NLSY79 data we look at four other measures of college participation. The remaining panels of tables 2.2a and 2.2b report estimates of the credit constrained for these measures. When we perform a parallel analysis for completion of four-year college, we find no evidence of constraints for white males and in fact over-adjust the gaps in college enrollment. Figures 2.7c and 2.7d present the raw and adjusted gaps respectively, for completion of four-year college. Figures 2.7e and 2.7f show the raw and adjusted gaps respectively, for delay of entry into college.[13] There is no evidence of short-run credit constraints in these measures. In results available from the authors on request, there is evidence of short-run credit constraints for the "dumb poor" in completing two years of

college, but not for the "bright poor." There is weak evidence in certain cells of the table for short-term credit constraints in years of delay of entry and for choice of two-year versus four-year colleges, which is a measure of school quality. Depending on the measure of college participation selected, the estimated percentage of white males constrained ranges from 0 to 9 percent. Setting statistically insignificant gaps to zero, we obtain a smaller range of values (0 to 7 percent). We obtain comparable results for other demographic groups.

Overall, the estimated percentage constrained ranges from 8 percent (for completion of two-year college) to 0 percent for completion of four-year college. The strongest evidence for short-term credit constraints is for Hispanic males. The illegality of many Hispanics may make them appear, as a group, to be constrained because Hispanics who are in the country illegally do not have the same eligibility for schooling aid as those who are legal residents. The weakest evidence for credit constraints is for black males. On many measures, the effective constraint for this group is zero. There is little evidence that short-term credit constraints explain much of their gap in college participation relative to other groups.

The analysis just may be faulted on the following grounds. Many of the variables on which we condition to control for long-term family factors also predict family income in the adolescent years, so the preceding analysis may just project family income in the adolescent year into "long term family factors." In response, it is important to note that the prediction of family income in the adolescent years on long term factors is not perfect. There is still independent variation in family income when these variables are controlled for.

We present two additional pieces of evidence to bolster the point made in tables 2.2a and 2.2b. First, in tables 2.2c and 2.2d, we reverse the roles of family income in the adolescent years and family background. We create an index of family background, defined precisely in the note to table 2.2 (and in appendix table 2B.4), and classify persons on the basis of quartiles of this index. The index includes a child's ability, parental education, and

location. It strongly predicts various college participation decisions. When we condition further on family income in the adolescent years (table 2.2c), a strong long run family background effect remains. This is true even if we report only statistically significant estimates (table 2.2d).[14] Figure 2.8 graphically presents the results of this analysis. The gaps by family status are not substantially affected by adjusting for family income in the adolescent years.

Table 2.3 reports further evidence on the unimportance of short-run credit constraints on college attendance. The table presents estimates of child enrollment in college on family per capita permanent income and on family per capita income flows received at various stages of the life cycle (transitory income). Permanent income is formed as an average discounted income flow to the family over the life of the child at home (ages 0 to 18).[15]

Two features are clear from this table: (a) permanent income matters a lot for college enrollment and (b) given permanent income, transitory income flows matter little. Early income and late income have positive but small and statistically insignificant effects (see column 4), but late income has, if anything, a slight *negative* effect on college enrollment. The evidence in table 2.3 suggests that short-term income constraints are not binding.[16]

Policies that improve the financing of the education of identified constrained subgroups will increase their human capital and may well be justified on objective cost-benefit criteria. The potential economic loss from delay in entering college can be substantial. If V is the economic value of attending school, and schooling is delayed one year, then the costs of delaying schooling by one year are $r1+rV$, where r is the rate of return. For $r=.10$, which is not out of line with estimates in the literature, this delay is 9 percent of the lifetime value of schooling (roughly $20,000). For the identified constrained subgroups, the benefits to reducing delay and promoting earlier college completion, higher college quality and graduation are likely to be substantial.

In designing policies to harvest these benefits, it is important to target the interventions toward the constrained. Broad-based policies generate deadweight. For example, Dynarski (2001) and Cameron and Heckman (1999) estimate that 93 percent of President Clinton's Hope Scholarship funds, which were directed toward middle-class families, were given to children who would have attended school even without the program.

While targeting those identified as constrained may be good policy, it is important not to lose sight of the main factors accounting for the gaps in figure 2.4. Family background factors crystallized in ability are the first-order factors explaining college attendance and completion gaps.

Differences in average ability by family income groups appear at early ages and persist. We discuss the sources of these differences in the next section. A major conclusion of this chapter is that the ability that is decisive in producing schooling differentials is shaped early in life. If we are to substantially eliminate ethnic and income differentials in schooling, we must start early, and we cannot rely on tuition policy applied in the child's adolescent years, job training, or GED programs to compensate for neglect the child has experienced in the early years.

At the same time, policies to foster early abilities are known to be costly. The mechanisms through which ability is generated remain to be fully explored. Policies that efficiently target the short-run constrained are likely to pass a rigorous cost-benefit test. We next consider other arguments used to support the claim of pervasive short-term credit constraints.

High Rate of Return to Schooling Compared to the Return on Physical Capital

Estimates of the rate of return to schooling, based on the Mincer earnings function, are often

above 10 percent and sometimes are as high as 17 to 20 percent. Estimates based on instrumental variables are especially high. (See, for example, the evidence surveyed by Card (1999, 2001) and the discussion of the quality of the instruments used in this literature presented in Carneiro and Heckman 2002.) It is sometimes claimed that the returns to schooling are very high and therefore people are credit-constrained or some other market failure is present.

The cross-section Mincerian rate of return to schooling does not, in general, estimate the marginal internal rate of return to schooling. (See Heckman, Lochner and Todd, 2003; and Heckman, Lochner, and Taber 1998a for an example in which cross-section rates of return are uninformative about the return to schooling that any person experiences.) Willis (1986) and Heckman, Lochner, and Todd (2001) state the conditions under which the Mincerian rate of return will be equal to the marginal internal rate of return to schooling. Even if these conditions are satisfied, implicit comparisons are usually made against a risk-free interest rate. However this is not the relevant comparison for evaluating schooling decisions. Carneiro, Hansen, and Heckman (2001, 2003) estimate considerable uncertainty in the returns to schooling. We discuss this evidence in the paper's third part. The illiquidity and irreversibility of human capital investments drive the premium on human capital far above the safe interest rate (see Judd 2000). Comparisons of Mincer returns and returns to capital are intrinsically uninformative about the existence of credit constraints or the need for intervention in human capital markets.

Are Rates of Return to Schooling Higher for Persons from Low-Income Families?

Assuming the same technology of educational investment across families and no comparative advantage in the labor market, if low-income families are credit-constrained, then at the

margin the returns to schooling for constrained children should be higher, since they are investing less than the efficient amount. Carneiro and Heckman (2002) establish that if choices are made at the quality margin, the estimated Mincer return may be *lower* for constrained persons, unless adjustments are made for quality. The empirical literature, which does not adjust for quality, finds that returns to schooling are higher for high-ability people than for low-ability people. (See, for example, Meghir and Palme 1999; Cawley et al., 2000; Taber 2001, or the evidence presented in part 3 below.) Family income and child ability are positively correlated, so one would expect higher returns to schooling for children of high-income families for this reason alone. Altonji and Dunn (1996) find in their preferred empirical specification that the returns to schooling are higher for children of more-educated families than for children of less-educated families. There is no evidence that rates of return to schooling are higher for children from low-income families than for children from high-income families.[17]

Additional Evidence from the Literature

Cameron and Heckman (1998) analyze the determinants of grade-by-grade schooling attainment for cohorts of American males born between 1908 and 1964. Consistent with the notion that family income and family background factors reflect long-run and not short-term influences on schooling attainment, they find that ability and family background factors are powerful determinants of schooling completion from elementary school through graduate school. An appeal to borrowing constraints operating in the college years is not necessary to explain the relationship between family income and college attendance decisions and the stability of the relationship over long periods of time.

Cameron and Taber (2000) examine the empirical importance of borrowing

constraints in a model that incorporates the insight that borrowing constraints will influence both schooling choices and returns to schooling. Using a variety of methods, they find no evidence that borrowing constraints play a role in explaining the years of schooling attained by recent cohorts of American youth. Keane and Wolpin (2001) estimate a more explicit sequential dynamic model and reach the same conclusion. Students are estimated to be short-run constrained, but alleviate the constraints they face through working. Relaxing the budget constraint barely budges schooling decisions but affects work while in school. Neither study looks at delay or quality effects, which have been found to be quantitatively important.

Stanley (1999) studies the impact of the GI Bill on the college-going decisions of Korean War veterans. Consistent with our analysis, he finds that most college subsidies under the bill were used by veterans from families in the top half of the socioeconomic distribution. When she studies the effects of the HOPE Scholarship program in Georgia, Dynarski (2000) finds that it benefits mostly middle- and higher-income students. The elasticity of enrollment to tuition subsidies in her sample is as high as other estimates found in the literature: middle- and higher-income people do not seem to respond less elastically to education subsidies than do lower-income people. This is consistent with the evidence from Cameron and Heckman (1999) previously discussed. Shea (2000) estimates the effect of a measure of parental income on schooling using the Panel Survey of Income Dynamics (see Hill 1992 for a description of this data set). Controlling for parental background variables, he finds an effect of his measure of family income on schooling, controlling for ability. Using instrumental variables, however, he estimates no effect of his measure of family income on schooling attainment, and he interprets this result as evidence of no credit constraints.[18]

Summary

In this section we have examined arguments made in the literature about the strength of credit constraints in schooling. We have evaluated the available evidence and presented new evidence using American data.

Some of the evidence in the literature is uninformative on this issue. The leading example is the evidence from IV and OLS estimation of the returns to schooling discussed in detail in Carneiro and Heckman (2002). The literature on price effects and tuition subsidies generally is also not very informative on this matter, since it does not separate price effects from borrowing constraints.

The observed correlation between family income and college attendance can be interpreted as arising in two different ways: from short-run credit constraints or from long-run family effects. The latter are quantitatively more important, even though we identify a group of people (at most 8 percent of the population) who seem to be facing short-run credit constraints. The first-order factors accounting for the gaps in figure 2.4 are long-term factors that cannot easily be offset by tuition policy or supplements to family income in the adolescent years of prospective students.

It is important to stress that all of the empirical analyses reported in this section are for contemporary American society, in which a substantial edifice of financial aid to support postsecondary education is in place. The limited role short-run credit constraints play in explaining contemporary American educational gaps is, no doubt, in part due to the successful operation of policies that were designed to eliminate such constraints. Substantial reductions in the generosity of educational benefits would undoubtedly affect participation in college, although they would operate primarily through price effects. The evidence in Blossfeld and Shavit 1993, Cameron and Heckman 1998, and Cossa 2000, however, suggests the universal first-order importance of long-term family influences on educational attainment. Gaps in educational attainment related to family background arise in many different

environments, including those with free tuition and no restrictions on college entry. This evidence points to the powerful role of the long-term factors that we have emphasized in this section of our paper. We next turn to evidence on the sources of these long-term factors.

Early Test Score Differentials

Important differences in ability across family types appear at early ages and persist. Figure 2.9a plots average percentile rank in PIAT (Peabody Individual Achievement Test) Math scores by age and family income quartile.

Constructing the graph in figure 2.9a, we computed for each person his or her percentile rank in the distribution of test scores at each age. Then we grouped individuals in different quartiles of family income and computed the average percentile rank within each group at each age the test was taken. We used ranks because the absolute values of test scores or their growth have no meaning. Any monotonic transformation of a test score is also a valid test score. Use of ranks avoids this difficulty. For all race and ethnic groups, there are important differences by family income quartile in how children rank in cognitive test scores as early as age 6. These gaps in ranks across income quartile remain stable as children grow, and for some test scores they widen. At the same time, just as racial differences in schooling participation rates are evident, racial differences in early test scores also emerge. Figure 2.9c presents evidence of the emergence of racial gaps in ranks of test scores, as measured by PIAT-Math test scores.

The ability that drives schooling participation is shaped early in life. The available evidence indicates that cognitive ability is relatively more malleable early in the life cycle (see Heckman 1995). Having access to more and higher-quality resources that contribute to improving cognitive ability early in life affects skill acquisition later in life.

Figure 2.10 presents ranks of adjusted test score gaps in figure 2.9, controlling for the long-term family factors listed at the top of the figure. The gaps in rank across racial and income groups are significantly reduced when we control for mother's education, mother's ability, and family structure in the test score equation.[19] The gaps at age 12 do not disappear, however, when we compare the highest and lowest income quartiles or whites with blacks. Measured long-term family factors play a powerful role but do not fully eliminate the gaps.

Other analysts have also focused their attention on these gaps in cognitive ability and have attempted to eliminate them by controlling for more factors. Using data from the Early Childhood Longitudinal Survey (ECLS), Fryer and Levitt (2002) eliminate the black-white gap in math and reading test scores in early kindergarten by controlling for measures of family background, birth weight, and number of books a child has.[20] They also find that both the raw and the residualized test score gaps widen with age. If anything, schooling widens these gaps, a point emphasized in Fryer and Levitt's paper. They cannot account for the increase in these gaps using available measures of school quality. Their evidence indicates that socioeconomic background at early ages is a very important determinant of a child's test score. Using data on the Children of the NLSY, Phillips et al. (1998) also study the black-white test score gap.[21] They analyze only the PIAT-Math and the Peabody Picture Vocabulary Tests at ages 3 to 4. They cannot fully eliminate the test score gap using family background, mother's AFQT, and rich measures of family environment, although controlling for these factors substantially reduces the gap.

The emergence of early test score differentials is not limited to cognitive measures. At early ages, differences in children's behaviors and attitudes across income and racial groups are also evident, as figure 2.11a illustrates. The figure presents differences in ranks of indices of Anti-Social behavior across different income and racial groups.[22] It is common knowledge that motivation, trustworthiness, and other behavioral skills are important traits for success in

life. We consider evidence on the importance of noncognitive skills in the next section. Hence, understanding the gaps in these behavioral skills across different income and racial groups and how to eliminate them is also important for understanding the determinants of economic success. Figure 2.12 presents adjusted ranks of test scores for behavioral measures for mother's ability, mother's AFQT, and broken home.[23] Adjusting for early family background factors substantially reduces gaps in ranks in noncognitive skills across income and racial groups. Comparing adjusted cognitive and noncognitive test scores reveals the importance of long-term factors in reducing the gaps in behavioral scores across these groups. Although noncognitive ability gaps across income and racial groups cannot be eliminated at later ages, controlling for mother's ability, family income, family structure, and location significantly reduces the gaps in ranks in noncognitive abilities across these groups at both early and later ages.[24]

This evidence, like that of the entire literature, is very crude. Good families promote cognitive, social, and behavioral skills. Bad families do not. The relevant policy issue is to determine what interventions in bad families are successful. We present evidence on this question after presenting further evidence on the importance of noncognitive skills. We show in the paper's third part that manipulating noncognitive skills is more feasible (less costly) than manipulating cognitive skills. In addition, remediation efforts for noncognitive skills are effective at later ages. But first we discuss the evidence on the importance of noncognitive skills for economic success.

The Evidence on the Importance of Noncognitive Skills

Numerous instances can be cited of high IQ people who fail to achieve success in life because they lack self-discipline and of low IQ people who succeed by virtue of persistence,

reliability, and self-discipline. It is thus surprising that academic discussions of skill and skill formation focus almost exclusively on measures of cognitive ability and ignore noncognitive skills. The early literature on human capital (Becker 1964) contrasted cognitive-ability models of earnings with human capital models, ignoring noncognitive traits entirely. The signaling literature (Spence 1974) emphasized that education was a signal of a one-dimensional ability, usually interpreted as a cognitive skill. Most discussions of ability bias in the estimated return to education treat omitted ability as cognitive ability and attempt to proxy the missing ability using cognitive tests. Most assessments of school reforms stress the gain from reforms as measured by the ability of students to perform on a standardized achievement test. Widespread use of standardized achievement and ability tests for admissions and educational evaluation are premised on the belief that the skills that can be tested are essential for success in schooling and in the workplace, a central premise of the educational-testing movement since its inception.

Much of the neglect of noncognitive skills in analyses of earnings, schooling, and other life outcomes is due to the lack of any reliable means of measuring them. Many different personality and motivational traits are lumped into the category of noncognitive skills. Psychologists have developed batteries of tests to measure these skills (Sternberg 1985). Companies use these tests to screen workers, but they are not yet used to ascertain college readiness or to evaluate the effectiveness of schools or reforms of schools. The literature on cognitive tests ascertains that one dominant factor ("g") summarizes cognitive tests and their effects on outcomes. No single factor has emerged as dominant in the literature on noncognitive skills and it is unlikely that one will ever be found, given the diversity of traits subsumed under the category of noncognitive skills.

Studies by Bowles and Gintis (1976), Edwards (1976), and Klein, Spady and Weiss (1991) demonstrate that job stability and dependability are traits most valued by employers as

ascertained by supervisor ratings and questions of employers, although they present no direct evidence on wages and educational attainment. Perseverance, dependability and consistency are the most important predictors of grades in school (Bowles and Gintis 1976).

Self-reported measures of persistence, self-esteem, optimism, future orientedness, and the like are now being collected, and some recent papers discuss estimates of the effects of these measures on earnings and schooling outcomes (see Bowles, Gintis, and Osborne 2001). These studies shed new light on the importance of noncognitive skills for success in social life. Yet these studies are not without controversy. For example, ex post assessments of self-esteem may be as much the consequence as the cause of the measures being investigated.

Heckman and Rubinstein (2001) avoid the problems inherent in these ex post assessments by using evidence from the GED testing program in the United States to demonstrate the quantitative importance of noncognitive skills in determining earnings and educational attainment. The GED program is a second-chance program that administers a battery of cognitive tests to self-selected high school dropouts to determine whether or not their level of academic attainment is equivalent to that of high school graduates. Study of the GED program is of interest in its own right. GEDs are a major output of government training programs, including the Job Corps program, as we note in the chapter's third part. Those awarded the GED constitute 15 percent of all persons certified with new high school credentials.

In this section of the chapter we summarize findings reported in Heckman, Hsee, and Rubinstein (2001) and Heckman and Rubinstein (2001). The GED examination is successful in psychometrically equating GED test takers with ordinary high school graduates who do not go on to college. Recipients are as smart as ordinary high school graduates who do not go on to college, where cognitive ability is measured by an average of cognitive components of the AFQT or by the first principal component ("g"). According to these same measures, GED

recipients are smarter than other high school dropouts who do not obtain a GED (see figure 2.13, which plots AFQT scores by race for high school graduates and GED recipients). The pattern is the same for all demographic groups. GED recipients earn more than other high school dropouts, have higher hourly wages, and finish more years of high school before they drop out. This is entirely consistent with the literature that emphasizes the importance of cognitive skills in determining labor market outcomes.

When measured ability is controlled for, however, GED recipients earn *less*, have lower hourly wages, and obtain lower levels of schooling than other high school dropouts. Some unmeasured factors therefore account for their relatively poor performance compared to other dropouts. Heckman and Rubinstein (2001) identify these factors as noncognitive skills noting that a subsequent analysis should parcel out which specific noncognitive skills are the most important.

The fact that someone has received the GED sends a mixed signal. Dropouts who pass the GED test are smarter (have higher cognitive skills) than other high school dropouts and yet at the same time have lower levels of noncognitive skills. Both types of skill are valued in the market and affect schooling choices. The findings of Heckman and Rubinstein (2001) challenge the conventional signaling literature, which assumes there is a single skill that determines socioeconomic success. It also demonstrates the folly of a psychometrically-oriented educational evaluation policy that assumes that cognitive skills are all that matter for success in life. Inadvertently, the GED has become a test that separates bright but nonpersistent and undisciplined dropouts from other dropouts. It is, then, no surprise that GED recipients are the ones who drop out of school, fail to complete college (Cameron and Heckman 1993) and fail to persist in the military (Laurence 2000). GED holders are “wise guys” who lack the ability to think ahead, persist in tasks, or to adapt to their environments. The performance of GED recipients compared to that of both high school dropouts of the

same ability and high school graduates demonstrates the importance of noncognitive skills in economic life.

Evidence from the GED Program

The performance of GED recipients compared to that of both high school dropouts of the same ability and high-school graduates demonstrates the importance of noncognitive skills in economic life. Boesel, Alsalam, and Smith (1998) present a comprehensive review of evidence on the GED program. Currently one in two high school dropouts and one in five high school graduates, as classified by the US Census, is a GED recipient.[25] A series of papers using NLSY data (Cameron and Heckman 1993; Heckman, Hsee, and Rubinstein 2001), have yielded the following findings regarding white males:

- In unadjusted cross-sectional comparisons, GED recipients have hourly wage rates and annual earnings substantially less than those of high school graduates and earn slightly more than other high school dropouts. The number of years of schooling is also slightly higher for GED recipients than for other dropouts. When their higher levels of schooling and their higher AFQT scores (as established in the previous subsection) are accounted for, GED recipients earn less than other high school dropouts and have lower hourly wages. Similar results for other demographic groups are reported in Heckman (2003). These results are statistically significant.
- Controlling for individual fixed effects (person-specific unobservables), longitudinal studies reveal no evidence of a permanent effect of GED certification on wages, employment, or job turnover for persons who take the GED after age 17. GED recipients are more likely to change jobs than high school dropouts both before and after taking the exam.

- Both cognitive and noncognitive skills promote educational attainment.
- In a model that explicitly accounts for both unmeasured (or badly measured) cognitive and noncognitive skills, in the short run GED certification appears to have the effect of boosting wages for persons who take the GED at young ages (younger than age 20), holding constant noncognitive skills by signaling greater cognitive ability of workers. This effect fades quickly, however, as employers rapidly learn about noncognitive ability. In the long run, holding ability constant, GED recipients earn lower wages as their adverse noncognitive characteristics are revealed.
- Persons with higher AFQT scores take the GED earlier. This accounts for a larger initial positive effect of GED certification on earnings for younger recipients that disappears with age.
- There is some suggestion that white-male GED recipients show the highest level among high-school dropouts of participation in (almost) every category of illegal activity. This is true even when the outcomes are not adjusted for differences in AFQT scores and educational attainment. It remains true even when we drop persons who acquire the GED in prison, or all persons who have been in prison, to avoid a spurious causal relationship arising from the inclusion of prisoners, and hence people with a greater rate of participation in crime, acquiring the GED. The same applies for white females except for teenage mothers, who are much less likely to get the GED in prison. GED recipients are more likely to participate in illegal drug use, drug selling, fighting in school, vandalism, shoplifting, theft, robberies, and school absenteeism than are other dropouts.[26]
- The labor force participation and employment rates of GED recipients are lower than those of other dropouts (conditional on AFQT scores and years of schooling completed). Their turnover rates are higher. These rates do not change with the

acquisition of the GED. Hence GED recipients accumulate less work experience over the life cycle.

- The correlation between AFQT scores and an index of participation in illicit activity defined in Heckman, Hsee, and Rubinstein (2001) is statistically significant and negative in the population at large. Individuals with higher AFQT scores are less likely to participate in illicit behavior. Yet this relationship does not hold within education groups. The correlation between AFQT scores and an index among all high school dropouts and one among high school graduates (with twelve years of schooling) is positive and statistically significant. It is especially strong for all dropouts, suggesting that among high school dropouts, the higher the AFQT score, the more likely is participation in illicit activity. Such a correlation is consistent with the view that both cognitive and noncognitive traits play important roles in determining graduation from high school.
- The story for white females is slightly different. Girls who drop out of school because of pregnancy typically do so with fewer years of schooling attained than other girls who drop out. Findings for girls who drop out for reasons other than pregnancy, however, are like those for teenage boys who drop out (i.e., they earn less than other dropouts conditioning on AFQT or schooling). Teenage mothers who are GED recipients have the same level of earnings as other high school dropouts once AFQT scores and years of schooling are accounted for.

Implications for Policy

We draw two main conclusions from our analysis of the importance of noncognitive skills in determining educational and life outcomes apart from the specific conclusion that holding a

GED sends a mixed signal about the holder that characterizes him or her as smart but unreliable. Current systems of evaluating educational reforms are based on changes in scores on cognitive tests. These tests capture only one of the many skills required for a successful life (see Heckman 1999). Our first conclusion is therefore that more comprehensive evaluation of educational systems would account for their effects on producing the noncognitive traits that are also valued in the market. There is substantial evidence that mentoring and motivational programs oriented toward disadvantaged teenagers are effective. We discuss this evidence in the paper's third part. Much of the effectiveness of early childhood interventions comes from boosting noncognitive skills and from fostering motivation. (See Heckman 2000 for a comprehensive review of the literature.) It has long been conjectured that the greater effectiveness of Catholic schools comes in producing more motivated and self-disciplined students (Coleman and Hoffer 1983). It has also been conjectured that the decline in discipline in inner-city public schools is a major source of their failure. It would be valuable to gather more systematic information on noncognitive effects of alternative education systems. IQ is fairly well set by age 8. Motivation and self-discipline are more malleable at later ages (Heckman 2000). Given the evidence on the quantitative importance of noncognitive traits, the second conclusion we draw from our analysis in this section is that social policy should be more active in attempting to alter noncognitive traits, especially in children from disadvantaged environments who receive poor discipline and little encouragement at home. This more active social-policy approach would include mentoring programs and stricter enforcement of discipline in the schools. We present evidence on the value of such interventions in the paper's third part. Such interventions would benefit the child and the larger society but at the same time might conflict with widely held values of sanctity of the family for those families that undervalue self-discipline and motivation and resent the imposition of what are perceived as middle-class values on their children.

Summary

The evidence presented in this part of the paper demonstrates that long-term environmental factors crystallized in cognitive and noncognitive abilities play a major role in accounting for gaps in schooling attainment across socioeconomic groups, where the short-term credit constraints and tuition factors that receive prominent attention in current policy discussions do not. Short-term credit constraints do, however, affect a small group of persons, and targeted-subsidy policies appear to be cost effective for those persons. We cannot expect tuition reduction policies to eliminate the substantial gaps in schooling attainment according to socioeconomic background. Gaps in levels of cognitive and noncognitive skills open up early and are linked to family environments at early ages, not parental income in the adolescent years. Noncognitive skills substantially determine socioeconomic success later in life.

In the next part of the chapter, we apply these lessons and add to them in our analyses of specific policies designed to foster skills in children and youth.

Analyses of Specific Policies

In this part of the chapter, we analyze the returns to schooling and schooling quality and the returns to job training, early childhood interventions, and mentoring programs. We also consider tax and subsidy policy, immigration policy, and problems associated with the transition to new technologies that demand new skills and make old skills obsolete.

The Returns to Schooling and Schooling Quality

Few topics in empirical economics have received more attention than the economic return to schooling. By now there is a firmly established consensus that the mean rate of return to a year of schooling, as of the 1990's, exceeds 10 percent and may be as high as 17 to 20 percent (Carneiro, Heckman, and Vytlacil 2001). This return is higher for more able people (Taber 2001) and for children from better backgrounds (Altonji and Dunn 1996). Those from better backgrounds and with higher ability are also more likely to attend college and earn a higher rate of return from it. This evidence is robust to alternative choices of instrumental variables and to the use of alternative methods for controlling for self-selection. The synergy or complementarity suggested in figure 2.6a is confirmed in estimates of ability and background on earnings. Both cognitive and noncognitive skills raise earnings through promoting schooling and through their direct effects on earnings. (See the evidence in Taber 2001; Heckman, Hsee, and Rubinstein 2001; Carneiro, Hansen, and Heckman 2001, 2003.) Table 2.4 presents our summary of the mean rate of return to schooling for different ability groups. The annual return to college is higher for persons with greater ability.

Means mask a lot of important information about the distribution of returns. Even if the mean returns to participants in schooling are high, marginal entrants attracted into schooling may have low returns. Economic analysis is all about persons at the margin. Although Mincer (1974) emphasized heterogeneity in the returns to education in his pioneering research on earnings functions and reported estimates of the dispersion of these returns, only recently have full distributions of returns and the returns to marginal entrants attracted into schooling been estimated (Carneiro, Hansen, and Heckman 2001, 2003). We summarize the main findings of this body of work.

The heterogeneity in rates of return can arise from cross-sectional differences known to agents but not to observing economists or from genuine uncertainty that agents face in making their schooling decisions. Both anticipated heterogeneity in returns and the

components of genuine uncertainty unknown to agents when they make their schooling decisions are estimated in recent research by Carneiro, Hansen, and Heckman (2001, 2003), who distinguish ex ante components of gains to schooling known to agents at the time they make their decisions from ex post realizations of those gains.[27]

Carneiro, Hansen, and Heckman's research extends the analysis of Willis and Rosen (1979) to identify distributions of outcomes of schooling. Figure 2.14 plots the ex post (realized) counterfactual distribution of the returns to college graduation (compared to high school graduation) for both college graduates and high school graduates who do not go on to college. About 7 percent of college graduates earn ex post negative returns. For them, going to college turns out to be a financial mistake. It would be a mistake for a greater proportion (14 percent) of those who stay in high school and do not go on to college.[28]

Carneiro, Hansen, and Heckman (2003) estimate that only a small amount of the variance in the utility returns to schooling is forecastable at the time college attendance decisions are made. One way to summarize their findings is presented in figure 2.15. It shows the reduction in the ex ante dispersion of the distribution of returns to college versus high school under a no-information assumption (no predictors) and a rich information set using all the information that agents act on in making schooling choices. Even under an information set that Carneiro, Hansen, and Heckman argue is implausibly rich, there is a great deal of intrinsic uncertainty about future returns at the time schooling decisions are made. This intrinsic uncertainty, coupled with the risk aversion that is estimated in Carneiro, Hansen, and Heckman's model helps to explain some of the apparent puzzle, discussed by Ellwood and Kane (2000), among others, that students react more strongly to costs than to returns. Direct costs (such as tuition) are known with near certainty. Future returns are uncertain. Risk aversion leads agents to discount returns relative to costs.

The evidence presented above suggests that there are great potential benefits to

gathering information to reduce uncertainty about future payoffs to schooling. Greater dispersion in ex ante returns among minorities and low-income majority groups than among majority groups partially explains the sluggish response of minorities and low-income majority whites to changes in the returns to schooling over time.

However, risk aversion is not the whole story or even the main story explaining the sluggish college enrollment rates. When they simulate an environment of full information, they find that only a small fraction of people regret their schooling choices ex post. Carneiro, Hansen, and Heckman show that nonpecuniary factors (associated with psychic costs, motivations and the like) play a major role in explaining why minorities and persons from low-income families do not attend college even though it is financially profitable to do so.

Returns to schooling for marginal entrants attracted into college by changes in tuition are below those of the average participant. Figure 2.16, taken from the work of Carneiro, Hansen, and Heckman (2001, 2003), shows that returns to schooling are lower for people less likely to attend college.[29] Carneiro (2002) also establishes that the marginal returns are lowest for the least able persons underscoring our emphasis on early ability. He analyzes different American datasets and he finds that, for most of them, the return to one year of college for the average college student (a high ability individual) is 4 to 15 percent larger than the return to one year of college for the average individual at the margin between attending college or not (a low ability individual). Ability greatly affects rates of return.

The Effects of Schooling on Measured Test Scores and the Effects of Test Scores on Wages

In recent work, Hansen, Heckman, and Mullen (2002) estimate the effect of schooling on test scores, accounting for the joint determination of schooling and tests.[30] It is well known that test scores predict schooling. It is more controversial that schooling raises measured test

scores. Herrnstein and Murray (1994) claim that the effects of schooling on test scores are weak. Winship and Korenman (1997) survey the literature on this subject. Hansen, Heckman, and Mullen (2002) estimate the effect of additional years of schooling on standardized test scores for persons age 14 and over at different levels of latent ability.[31] Schooling is found to raise measured achievement (AFQT) by two-tenths of a standard deviation per year. This effect is uniform across latent ability levels. There are substantial gains in test scores in the early high school years. But because of parallelism across ability levels in the effects of schooling on achievement test scores, schooling does not eliminate initial disadvantages in test scores across latent ability levels. Because the relationship between log wages and test scores is nonlinear (see Heckman and Vytlacil 2001), schooling tends to equalize wages for those at the bottom of the latent test score distribution.

The research of Hansen, Heckman and Mullen shows that schooling has an additional effect on earnings through raising ability beyond its direct effect on earnings. Estimates of returns to schooling that condition on measured test scores that are reported in the literature lead to downward-biased estimates of the return to schooling.

Raising Schooling Quality

The most commonly suggested reforms for schools are class size reductions, institution of summer school programs, and increases in teacher salaries and per-student expenditures. Krueger (1999) suggests that these interventions are likely to be cost effective. Some of the evidence on the success of such initiatives is based on experimental evidence, such as that from the Tennessee Student-Teacher Achievement Ratio (STAR) program. Evidence on the results of this program has been mixed; kindergarten students in smaller classes initially have higher test scores than those in larger classes, but in later grades, treatment and control group

students' test scores move much closer together, although there is still a small positive effect of the program (see Hanushek 2000; for an opposing view, see Krueger 1999). There is no evidence that class size reductions of the sort reported in the Tennessee STAR experiment will substantially affect earnings or reduce the substantial skill gaps across socioeconomic groups in American society. Even if the test score gains from class size reduction can be shown to be persistent, test scores are only weakly linked to earnings later in life (Cawley, Heckman, and Vytlacil 1999; Heckman and Vytlacil 2001).

Studies linking measures of schooling quality to lifetime earnings and occupational achievement have recently appeared, making unnecessary reliance on inherently arbitrarily scaled test scores for evaluating the effectiveness of interventions in schooling quality. There is a growing consensus as a result of these studies that within current ranges in most developed economies, changes in measured inputs such as class size and spending per pupil have weak effects on the future earnings of students (see Heckman, Layne-Farrar, and Todd 1996; Hanushek 1998, 2002). Even if one takes the most favorable estimates from the literature and combines them with the best-case scenario for the costs of raising schooling quality, decreasing the pupil-teacher ratio by 5 pupils per teacher does not turn out to be a wise investment. Such a reduction in the pupil-teacher ratio, while keeping the number of students enrolled the same, would require the addition of new teachers, not to mention the addition of new classroom and school facilities. Accounting only for the costs of adding new teachers, we estimate that decreasing the pupil-teacher ratio by 5 pupils per teacher would cost about $790 per student.[32] Table 2.5 presents estimates of the net returns for such a reduction in pupil-teacher ratio under different assumptions about productivity growth, discount rates, and the social opportunity costs of funds.[33] Taking a high estimate (relative to the estimates reported in the literature) of a 4 percent increase in future earnings resulting from a decrease in the pupil-teacher ratio by 5 pupils per teacher yields a *loss* of lifetime

earnings of between $2,600 and $5,500 per 1990 high school graduate at standard discount rates (5 to 7 percent).

Card and Krueger (1997) argue that productivity growth in wages should be included in calculations of returns to reductions in the pupil-teacher ratio. Using a 1 percent productivity growth rate, which is consistent with historical experience, does not reverse the conclusion reached as a result of such calculations. Even using a 3 percent productivity growth rate in wages (calculations not shown), which is a high estimate outside of historical experience, does not offset the costs unless one uses a 3 percent discount rate.[34] Estimates of the net returns to reductions in the pupil-teacher ratio are even more negative after the social costs of taxation are accounted for. Only if we take very high-end estimates of the effect of schooling quality on earnings and discount costs by a very low rate (3 percent) do we find any sizeable positive effect of schooling quality on future earnings.

The evidence presented here regarding the returns to reductions in pupil-teacher ratios indicates that the United States may be spending too much on students given the current organization of educational production. Pouring more funds into schools to lower class sizes by one or two pupils or to raise spending per pupil by a few hundred dollars will not solve the problems of the American primary and secondary school system, nor will it stimulate the college going of minorities and the poor. This is not to say that school quality does not matter. Hanushek (1971, 1997), Murnane (1975), and Hanushek and Luque (2000) all show that individual teachers matter in the sense of raising the test scores of students. Conventional measures of teacher quality do not, however, predict who are the good teachers. Giving principals more discretion in rewarding and punishing teachers would be an effective way to use local knowledge. Bureaucratization hinders use of this knowledge.

Although the effects of schooling quality vary across environments and additional funding for some schools may be justified, marginal improvements in school quality are

likely to be ineffective in raising lifetime earnings and more fundamental changes are required if we hope to see a significant improvement in our educational system.

Improving School Quality Through Choice in Schooling

It is commonly perceived that despite the high estimated returns to schooling, American primary and secondary schools as a whole are failing. The evidence for this failure is both the dismal ranking of the performance of American high school students on standardized achievement tests compared to that of students from other nations and stagnant test scores among American students over time (see the evidence presented in Blau and Kahn 2001; OECD and Statistics Canada 1995; and Hanushek 2000). Determining how to fix this problem requires an understanding of how American schools are organized. By and large, public school systems in the United States are local monopolies with few competitors. The incentives of many principals and teachers to produce knowledge are weak, although there are many dedicated professionals in these schools who work hard without reward. Educational bureaucracies are often unresponsive to the changing demand for skills or to the market realities that will confront their students when they leave schools. They are not accountable to anyone because it is not easy to monitor them. One valuable source of information--parental and student perception of the qualities of teachers and schools--is rarely used to punish poor teaching.

School choice has been advocated as a reform to improve the quality of educational services for students. Proponents of school choice argue that competition among schools to attract students will force schools to decrease costs and increase the quality of services provided. Additionally, by having parents actively choose the schools attended by their children, school choice systems would likely increase the degree of parental involvement in

children's schooling. On the other hand, opponents of school choice argue that increased competition among schools will lead to increased stratification and inequality among students as well as a dilution of basic schooling standards and that poor parents lack the information and the ability to make informed decisions for their children. Hence, school choice systems would be most beneficial to those already able to exercise choice in the current system, the richer families.

Most of the research on this topic has been theoretical. Although there is some degree of choice within the current U.S. schooling system that can be explored to understand the mechanisms of school choice, the data are often lacking and when available are generally inconclusive.

Voucher experiments provide data for empirical studies concerning school choice. Experiments that give tuition vouchers to public-school students so that they may attend private schools have been conducted in several U.S. cities, including Milwaukee, Cleveland, Minneapolis, and New York.[35] These experiments have been studied but the conclusions of these studies have been controversial. Researchers do not agree on whether vouchers have any impact on students' educational achievement. Recent research (see Peterson and Hassel 1998) shows important differences in and parental satisfaction. Relative to parents not allowed to exercise choice, parents under school choice systems are more likely than other parents to report satisfaction with their children's school. These voucher experiments are often limited in their scale, and it is difficult to generalize any findings from them to the national level. Any national voucher program will most likely have large general-equilibrium effects that cannot be estimated from these small-scale experiments (see Urquiola and Hsieh 2002).

Other researchers have studied the effect of introducing competition among public schools into the monopolistic setting of the U.S. public school system. Evidence from these

studies indicates that increased school competition and student and parental choice improves the quality of schools, as measured by test scores and by parental and student satisfaction with learning. Contrary to the view that competition siphons resources away from the public sector to its detriment, Caroline Hoxby's (2000) research suggests that when public schools are subject to greater competition both from parochial and other private schools, the performance of all schools increases. Higher levels of achievement are produced at lower cost.

Cullen, Jacob, and Levitt (2000) present evidence on competition among schools in the Chicago Public Schools. They find that those students who change schools given the choice have higher high school graduation rates than observationally identical students who remain at their assigned schools. They explain this outcome as resulting from student sorting. School choice allows higher-ability students to sort to higher-quality schools and increase their likelihood of high school graduation. Even though choice helps high-quality students, it does not seem to hurt low-ability students.

A study by Derek Neal (1997) demonstrates that the higher schooling attainment of students in Catholic schools compared to those in public schools is largely a consequence of gains registered by inner-city students who choose Catholic schools over inferior inner-city public schools. In the suburbs, where districts are smaller and competition among school districts is more intense, the Catholic schools have little advantage over the public schools, and the performance of both school systems is higher than in the inner-city schools. Grogger and Neal (2000) present substantial evidence confirmatory of the original Neal study using a broader set of outcome measures, including measured achievement and attainment.

It is remarkable that in a society as committed to consumer sovereignty and choice as the American society, there is so much resistance to permitting choice and instituting incentives in education. The conventional argument of educational planners is that parents

and students are not able to make wise choices. The available evidence points to better outcomes from increased school competition but it is far from definitive. Policies that promote such competition are much more likely to raise schooling performance than policies that increase schooling quality and do not change the organization of schools. Exact quantitative trade-offs, however, are not available (see Hanushek 2000, 2002).

Early Childhood Investments

The evidence presented in the second part of this chapter suggests that both cognitive and noncognitive abilities affect schooling and economic success and that socioeconomic differences in cognitive and noncognitive skills appear early and, if anything, widen over the life cycle of the child. We demonstrate there that parental inputs are important correlates of these skills. Yet the policy intervention indicated by this evidence is far from obvious, because the exact causal mechanisms through which good families produce good children are not yet well understood. Perhaps for this reason, American society has been reluctant to intervene in family life, especially in the early years.

There is a profound asymmetry in popular views about family life and schooling. On the one hand, there is a widespread belief that parents cannot make wise choices about their children's schooling. If that is true, then how can parents be trusted to make correct decisions in the preschool years, which recent research has demonstrated to be so important for lifetime success? The logical extension of the paternalistic argument that denies the wisdom of parental sovereignty in choosing schools would suggest that the state should play a far more active role in the preschool life of the child. That is a position that few would accept.

Paternalistic interventions in the early life of children in certain dysfunctional families may be appropriate. If we are to violate the principle of family sovereignty anywhere in the

life cycle process of learning, the case for doing so is strongest at the preschool stage (and only for some groups) and not at later stages of formal schooling, for which the argument for paternalism is most often made. Dysfunctional families and environments are major sources of social problems. Paternalistic interventions into the life of such families may be warranted on efficiency grounds, although such interventions raise serious questions about the need to protect the sanctity of family life.

Recent small-scale studies of early childhood investments in children from disadvantaged environments have shown remarkable success and indicate that interventions in the early years can effectively promote learning and can be enriched through external channels. They demonstrate the value of good families by showing that interventions can remedy the failings of bad families. Early childhood interventions of high quality have lasting effects on learning and motivation. They raise achievement and noncognitive skills, but they do not raise IQ. Disadvantaged subnormal IQ children (average IQ = 80) in Ypsilanti, Michigan, were randomly assigned to the Perry Preschool program, and intensive treatment was administered to them at ages 4 to 5. Their parents were also subject to interventions. Treatment was then discontinued, and the children were followed over their life cycle. Evidence on the treatment group, which is now about thirty-five years old, indicates that those enrolled in the program have higher earnings and lower levels of criminal behavior in their late twenties than did comparable children randomized out of the program. Reported benefit-cost ratios for the program are substantial. Measured through age 27, the program returns $5.70 for every dollar spent. When returns are projected for the remainder of the lives of program participants, the return on the dollar rises to $8.70. A substantial fraction (65 percent) of the return to the program has been attributed to reductions in crime (Schweinhart, Barnes, and Weikart 1993). The Syracuse Preschool program provided family development support for disadvantaged children, from prenatal care for their mothers through age 5 of the

children' lives. Reductions in problems with probation and criminal offenses ten years later were as large as 70 percent among children randomly assigned to the program. Girls who participated in the program also showed greater school achievement (Lally, Mangione, and Honig. 1988). Studies have found short-term increases in test scores, less in-grade retention, and higher high school graduation rates among children enrolled in early intervention programs. Of those studies that examine predelinquent or criminal behavior, most have found lower rates of such behavior among program participants. Table 2.6 summarizes of the effects of selected early intervention programs on student test scores, schooling, earnings, and delinquency. Table 2.7 recounts the findings of studies on the Perry Preschool program, and a cost-benefit analysis of that program. The benefit-cost ratio is substantially greater than one. Recent estimates of the internal rate of return to the program are 13 percent (Barnett, personal communication, 2002). This number looks low relative to the 15 to 20 percent return for schooling reported by Carneiro (2002). It should be compared to the return for low-ability students, because the Perry program only recruited low-ability children. Table 2.4 shows that the return to one year of college for the average individual in the fifth percentile of the ability distribution is 11 percent and the return to college for the average individual in the fifth percentile of the ability distribution not attending college is 7 percent. (Most of the population at this percentile of the ability distribution is not attending college, so the latter is the relevant number for the comparison.) If we examine to individuals at the twenty-fifth percentile of the ability distribution, higher than the percentile for the Perry participants, this return rises to 9.5 percent. We conjecture that the returns to maternal inputs at early ages are very high for normal children and that 13 percent is a lower bound on the return for normal children, although there is no direct evidence on this issue. At the same time, the gap between schooling and preschooling returns might widen if there are substantial noncognitive returns to schooling that we have not enumerated.

Evidence on the more universal Head Start program is less clear, but the program is quite heterogeneous and is much less well funded than the Perry Preschool program. Currie and Thomas (1995) find short-term gains in test scores for all children participating in Head Start; most of those gains decayed quickly, however, for African American children after they left the program. Currie and Thomas conclude that either differences in local-program administration or in quality of schooling subsequent to the Head Start program are at the root of the differences between the outcomes for black and white children. Ramey et al. (1988) note that the schools attended by the Perry Preschool children were of substantially higher quality than those attended by the typical Head Start child. In addition, the Perry program also taught parenting skills and arguably put better long-term environments in place for the children. The failure to support in subsequent years the initial positive stimulus of Head Start may account for the decline in the impact of Head Start over time, and may account for its apparent ineffectiveness compared to the Perry Preschool program. In a more recent paper, Garces, Thomas and Currie (2002) find substantial long term effect of Head Start on high school graduation, college attendance, earnings and crime. The largest effects are for individuals whose mothers have less than a high school education. Among whites in this group, attending Head Start leads to a 28 percent increase in the probability of high school graduation, a 27 percent increase in the probability of college attendance and a 100 percent increase in earnings measured in the early twenties. For blacks, the likelihood of being booked or charged with crime is 12 percent lower for those who attended Head Start than for those who did not.

In light of our discussion in the chapter's second part, an emphasis on cognitive test scores appears to be misplaced. It appears that early childhood programs are most effective in changing noncognitive skills, although they also raise achievement test scores (as opposed to IQ). We also note that eventual decay of initial gains in test scores, like those found in regard

to the Head Start program, were found for programs like Perry Preschool as well, but the long-term evaluations of these programs are quite favorable in terms of participants' success in school and society at large. The psychometric test score literature is not clear about the relationship between early test scores and success in school, graduation rates, socialization, and labor market outcomes. The fade-out effects in test scores found for the Head Start program do not imply that participation in the program has no long-term beneficial effects. Head Start may improve the lifetime prospects of its participants, despite yielding only short-term gains in test scores, which may not measure many relevant dimensions of social and emotional skills.

The Perry intervention affected both children and parents. Parents in the program improved their education and labor force activity and reduced their participation in welfare. Successful enrichment programs like Perry Preschool foster long-term improvements in the home environment that carry over to the child long after the program has terminated. Head Start offers a staff of much lower quality (and much lower paid), part-time classes for children, and limited parental involvement. The program terminates without any substantial intervention into or improvement in the home environments of the disadvantaged children. Improvements in Head Start, proponents argue, are likely to produce effects closer to those observed in more-successful small-scale programs. Given the potential for success of such programs (as exhibited by the Perry Preschool experiment), more studies of the long-term impacts of various types of small-scale and broad-based early intervention programs are certainly warranted. Provocative calculations by John Donohue and Peter Siegelman (1998) indicate that if enriched early intervention programs were targeted toward high-risk, disadvantaged minority male youth, the expected savings in incarceration costs alone would more than repay the substantial costs of these enriched programs.

An important lesson to draw from the Perry Preschool program, and indeed from the

entire literature on successful early interventions, is that the social skills and motivation of the child are more easily altered than his or her IQ. These social and emotional skills affect performance in school and in the workplace. Academics have a bias toward believing that cognitive skills are of fundamental importance to success in life. Because of this, the relatively low malleability of IQs after early ages has led many to proclaim a variety of interventions to be ineffective. Yet the evidence from the Perry Preschool program and the evidence presented in table 2.8 reveals that early intervention programs are highly effective in reducing criminal activity, promoting social skills, and integrating disadvantaged children into mainstream society. The greatest benefits of these programs are their effects on socialization and not those on IQ. Social skills and motivation have large payoffs in the labor market, so these programs have the potential for a large payoff.

At the same time, it is important to be cautious about the evidence from these programs. Whether they can be replicated on a large scale is an issue. Like those in the Tennessee STAR program, teachers in the early intervention programs studied may have been motivated more than would be possible in a permanent large-scale program. Proper accounting for future benefits is required before strong conclusions can be drawn. The substantial gap in time between the payment in terms of costs and the harvest of benefits requires that these benefits be substantial to justify early intervention programs. Prima facie the benefits are there, but a stronger case would be desirable.

We next turn to the evidence on the effectiveness of interventions for older children. Programs aimed at intervening in the lives of children in their teen years attempt to redress the damage of bad childhoods. Although these programs do not raise participants' IQ, there is some evidence that they can affect their social skills (noncognitive abilities), because the prefrontal cortex, which controls emotion and behavior, is malleable until the late teenage years (Shonkoff and Phillips 2000).

Interventions in the Adolescent Years

How effective are interventions in the adolescent years? Is it possible to remedy the consequences of neglect in the early years? These questions are relevant because cognitive abilities are fairly well determined and stable by ages 8 to 9 in the sense that IQ at later ages is highly correlated with IQ at those ages. Just as early intervention programs have a high payoff primarily because of the social skills and motivation they impart to the child and the improved home environment they produce, so do interventions that operate during the adolescent years, and for many of the same reasons.

Table 2.10 summarizes evidence on the effects of adolescent interventions on education, earnings, and crime rates. There are few estimates of rates of return for these programs. School-based and training-based programs are compared in the table. We briefly discuss here what is known about school-based interventions during the adolescent years. A few recent studies of mentoring programs, like the Big Brothers/Big Sisters (BB/BS) and the Philadelphia Futures Sponsor-A-Scholar (SAS) programs, have shown that these programs have broad positive social and academic impacts on participating school-aged children and adolescents. BB/BS pairs unrelated adult volunteers with youth from single-parent households for the purpose of providing youth with an adult friend. This promotes private youth development and surrogate parenthood. No specific attempts are made to ameliorate particular deficiencies or to reach specific educational goals; a broad, supportive role is envisioned for the mentor. In a random-assignment study, Tierney and Grossman (1995) found that eighteen months after being matched with a mentor, Little Brothers and Sisters (ages 10 to 16 at the time of the match) were less likely to have initiated drug or alcohol use, to hit someone, to skip class or a day of school, or to lie to their parents; they had higher

average grades and were more likely to feel competent in their school work and report a better relationship with their parents.

The primary goal of SAS is to help students from Philadelphia public high schools make it to college. The program provides long-term mentoring (throughout high school and for one year beyond), substantial academic support, help with college application and financial-aid procedures, and financial support for college-related expenses. Individually matched mentors serve as surrogate parents, provide a successful role model, monitor student progress, and provide encouragement and support. SAS provides students with $6,000 in financial assistance throughout college for those choosing to enroll in an accredited two- or four-year postsecondary institution. The program also provides a coordinator for groups of about thirty students to ensure a successful relationship is built between mentors and students. Using a matched sample of non-SAS students in Philadelphia high schools[36], Johnson (1996) estimates statistically significant increases in grade point averages for tenth and eleventh grades, as well as a 22 percent (16 percent) increase in college attendance one year (two years) after graduation from high school. Because the primary goal of SAS is to increase college enrollment, Johnson did not collect other social and psychological measures.

Much like SAS, the Quantum Opportunity Program (QOP) offered disadvantaged minority students counseling and financial incentives (one dollar up front and one dollar put in a college fund) for every hour spent in activities aimed at improving social and market skills. Students who were randomly chosen to participate in the program were provided with a mentor at the beginning of ninth grade. All participants were kept in the program for four years regardless of whether they stayed in school. Over four years, the average participant logged 1,286 hours of educational activities like studying with tutors or visiting museums. Two years after program completion, about a third more participating students graduated from high school (or obtained a GED) than similar nonparticipants. Since many participants

were enrolled in postsecondary schooling at the time of the follow-up study, it is difficult to determine the program's effect on earnings. Arrest rates for program participants, however, were one-half those for nonparticipants. These benefits did not come without substantial expenditures, however, as the average four-year cost per participant was $10,600. Still, a cost-benefit analysis estimated positive net social returns to QOP. (See Taggart 1995 for a more detailed description of the program and an evaluation of its impacts). Tables 2.9-2.10 present evidence from a randomized-trial evaluation of the Quantum program. Again, the evidence shows that QOP and programs like it can dramatically improve social skills and the adaptation of adolescents to society.

Two other studies provide additional evidence that creative programs designed to keep adolescents in school can be effective. These are discussed more extensively in Heckman 2000 and Heckman and Lochner 2000, and we merely summarize these discussions here. Ohio's Learning, Earning, and Parenting (LEAP) program and the Teenage Parent Demonstration (TPD) provided financial incentives for teenage parents on welfare to stay in school or take GED classes (or, alternatively, imposed financial penalties for nonenrollment). LEAP showed increases in high school graduation or GED rates among randomly assigned participants who were still enrolled in school when they entered the program. TPD showed mixed results on education depending on the program site. Young women who had already dropped out of school at the time of enrollment in the program (and, to a lesser extent, those who were still attending school when they entered the program) may have substituted GED training for high school graduation as an easier means for meeting program requirements, raising concerns about an unintended, potentially negative effect.[37] Both of these programs show positive post-program effects on earnings and employment for students who were still in school when they entered the program. The effects were often negative, however, for participants who had already dropped out of school before entering the program. Both studies

thus show more positive impacts for individuals still enrolled in school than for dropouts.[38] It is still unknown whether the effects of the programs are more positive for those still in school because, on average, they are of higher ability than those who have already dropped out, or because there is some advantage to intervening before adolescents leave school.

The available schooling literature demonstrates that providing disadvantaged students with financial incentives to stay in school and participate in learning activities can increase schooling and improve employment outcomes. It should be noted that although programs providing such incentives have proven to influence employment and earnings positively (and, in the case of QOP, to reduce crime), they do not perform miracles. The impacts they achieve are modest, but positive. (See the estimates in table 2.10). We discuss the estimates for Job Corps in the next section.

The Summer Training and Employment Program (STEP) provided remedial academic education and summer jobs to disadvantaged youth ages 14 and 15. Each summer, participants enrolled in 110 hours of classes and 90 hours of part-time work. Although program participants achieved modest short-term gains in reading and math skills, those gains did not last. Two to three years after program completion, program participation was found to have no effects on high school graduation rates, grades, or employment (see table 2.10). The program has been criticized for not attempting to follow up on its summer program with a school year curriculum. Maryland's Tomorrow program did just that: It combined an intensive summer program with a school year follow-up, offering participants summer jobs and academic instruction, career guidance, and counseling through adult mentors, peer support, or tutoring. Although the program did not reduce final dropout rates, it did seem to delay dropout (dropout rates were lower for program participants during the ninth grade but not by the end of the twelfth grade). The program also increased the pass rate for twelfth grade students taking the Maryland Functional Tests, a series of tests of basic skills (see

Heckman and Lochner 2000).

The evidence on programs aimed at increasing the skills and earnings of disadvantaged youth suggests that sustained interventions targeted at adolescents still enrolled in school can positively affect learning and subsequent employment and earnings.[39] The studies discussed in this section also suggest that interventions for dropouts are much less successful. Unfortunately, they do not reveal why. We do not know whether there is some advantage to intervening in a young person's life if he or she has already made the decision to drop out, or whether those who choose to drop out have less motivation and lower ability, making programs less effective for them regardless of when the intervention takes place. It is important to remember, however, that the interventions conducted by such programs only alleviate and do not reverse early damage caused by bad family environments.

Public and Private Job Training

Because of a lack of data and a bias in favor of the funding of studies of government training, the returns to private-sector training are less well studied than the returns to public-sector training. Studies by Lynch (1992, 1993), Lillard and Tan (1986), Bishop (1994), and Bartel (1992) find sizable effects of private-sector training on earnings. In comparison with studies of public-sector training, most of these studies do not attempt to control for the bias that arises because more-able persons are more likely to undertake training, so estimated rates of return overstate the true returns to training by combining them with the return to ability. Part of the measured return may result from the fact that more-motivated and able persons undertake training. Upper-bound estimates of the return to training for marginal entrants range from 16 to 26 percent and are comparable to those obtained from education (see table 2.11).

An important feature of private sector training is that the more-skilled participants in such training do more investing in human capital even after they attain high skill levels. Different types of training and learning have strong complementarities with respect to one another. The hypothesis of universal complementarity that underlies figures 2.6a and 2.6b receives support in recent U.S. data. Table 2.12 analyzes participation in training for different demographic groups. As shown in column 1, more-able people (as measured by AFQT) and people with more schooling are more likely to participate in company training. This is further evidence on dynamic complementarity that supports our thesis that skill begets skill and that motivates figure 2.6a and 2.6b. Those with higher parental income, however, (as measured by family income at age 14 and by father's education), after their own education and their own ability are controlled for, are more likely to train in companies after completing their schooling. Private financing arrangements between workers and firms appear to offset family income constraints and partially offset initial disadvantages. On net, however, postschool training is neither equalizing nor disequalizing. Column 2 of the table reports the net effect of parental background and family income, with neither schooling nor ability controlled for. For most demographic groups, private job training is neutral with respect to family background after its effects on ability and schooling are netted out.

Low-skilled persons typically do not participate in private-sector training. Firms can be exclusive regarding participation in programs they fund in ways that government training programs for disadvantaged workers are designed not to be. The lack of interest of private firms in training disadvantaged workers indicates the difficulty of the task and the likely low return to this activity. The best available evidence indicates that public training programs are an inefficient transfer mechanism and an inefficient investment policy for low-skilled adult workers. We present that evidence next.

Evidence about Conventional Public Training and Work-Welfare Programs

Before we turn to a discussion of the benefits of specific training programs, it is important to reiterate a few general points that critically affect how we interpret the evidence on training. In evaluating any public project, it is necessary to account for the welfare costs of raising public funds as well as the direct costs of providing the services.[40] In accounting for human capital projects (or any other type of investment project), it is necessary to estimate accurately the time series of the returns and to discount it appropriately to compare with project costs. Table 2.13 shows the importance of applying these principles. It takes experimental estimates from the evaluation of the JTPA program (see Bloom et al. 1993) and makes alternative assumptions about benefit duration, costs, welfare costs, interest rates for discounting, and the welfare cost of public funds. Accounting for these factors vitally affect the estimates of the economic return to training. Especially important is the assumption about benefit duration. The JTPA evaluation followed participants for only thirty months. When the benefits of the training provided are assumed to persist for seven years, the estimated effects are larger in absolute value.[41] On the other hand, Ashenfelter (1978) estimated a 13 percent annual depreciation rate of the first round impact on earnings, which suggests that an assumption of no depreciation is grossly at odds with the evidence. Heckman, LaLonde, and Smith (1999) present a comprehensive survey of the economic return to public-sector training, so it is unnecessary to restate their evidence here. Table 12.4, taken from a recent survey by Martin and Grubb (2001), suggests some general lessons from the empirical literature on job training.

Job training is a heterogeneous activity. It includes classroom education, make work, subsidized employment and job search. The rate of return to classroom training is sizeable (Heckman et al. 2000). The rates of return for other components of training, however, are

generally lower, although subsidized work (as in the National Supported Work study) appears to have a large payoff. Even when an activity such as job search assistance is profitable, the scale of and gains from the activity are low. One cannot expect substantial benefits from job training. Missing from the literature is a detailed cost-benefit analysis of specific activities of training programs, although Heckman, LaLonde, and Smith (1999) and Martin and Grubb (2001) go part of the way toward developing such an analysis. Such assessments of the empirical evidence move the discussion beyond blanket statements about entire programs and allow discussions of public policy to focus on parts of the programs that are targeted to specific populations and are effective.

Like the heterogeneity found in studies of the earnings response to education, there is considerable evidence of heterogeneity in response to treatment in job training (Heckman, Smith, and Clements 1997). Treatment is found to be most effective for those at the high end of the wage distribution. It has no effect for those at the bottom. There are substantial gains to be realized from targeting treatment. The information required to do so effectively, however, is generally not available (see Heckman, Heinrich, and Smith 2002). The returns to job training for older workers and displaced workers are very low, a consistent finding of the literature on this subject that is also consistent with the general picture presented in figure 2.6a.

The Recent Job Corps Study

Job Corps has recently been evaluated using experimental methods, and the results have been widely trumpeted as evidence of success for government training (Burghardt and Schochet 2001). Although the results of the evaluation for some groups are encouraging, the findings from the new Job Corps study are consistent with the previous literature on job training

programs. Except for white teenagers ages 16 to 17, the results for earnings and employment are in line with the disappointing results found for most job training programs. It would be surprising to find a substantial impact of Job Corps on labor market outcomes, given that it is a GED factory and the economic return to the GED is low (see figure 2.17). Among white and black males ages 20 to 24, the annualized impacts of Job Corps participation are substantial. Over the four-year course of the experiment, however, the net benefit is only $624 (over four years) and not statistically significant. The large positive results for Job Corps training reported in the popular press (Krueger 2000) are based on out-of-sample forecasts that assume that benefits of participation last indefinitely. Table 2.15 is taken from the recent Job Corps study. The substantial excess of benefit over cost reported in line labeled *Benefits minus costs* is a consequence of the assumption by the Job Corps analysts that benefits last indefinitely. Making the opposite assumption, that benefits do not last at all, the net return is negative (see the line labeled *Benefits minus costs excluding extrapolation beyond observation*). It is also negative if one uses Ashenfelter's 13 percent estimated depreciation rate for males. Accounting for the social costs of taxation required to finance the Job Corps would make these negative benefit-cost accounts even more negative. There is no empirical support for the assumption that benefits of program participation last indefinitely, and no social-welfare cost of taxation is used to adjust costs in the main Job Corps report. As previously noted, many other programs have substantial rates of return if we assume that benefits persist into the indefinite future and if social costs of taxation are ignored. Before serious policy can be based on the Job Corps study, its assumptions must be more strongly defended. The most accurate assessment of what the Job Corps study shows is best summarized by a quotation from the final report:

> Over the whole period Job Corps participants earned about $3 per week (or about $624 overall) more than they would have if they had not enrolled in Job Corps. This impact,

however, is not statistically significant" (Burghardt and Schochet 2001, p.xlii)

Summary of Training Impacts

A comparison of the job training programs discussed in this section suggests a few important lessons. First, you get what you pay for. The recently terminated JTPA program cost very little but produced very few results. An exception to the rule is classroom training, the returns to which are substantial (Heckman et al., 2000). Second, the effects of treatment vary substantially among subgroups (Heckman, LaLonde, and Smith 1999). Third, job training programs also have effects on behavior beyond schooling and work that should be considered in evaluating their full effects. Reductions in crime may be an important impact of programs targeted at male youth. The evidence summarized in Heckman, LaLonde, and Smith 1999 indicates that the rate of return to most U.S. and European training programs is far below 10 percent, although the benefits to certain groups may be substantial, and some may pass cost-benefit tests. We cannot look to public job training to remedy or alleviate substantially skill deficits that arise at early ages. We next consider tax policy.

Tax and Subsidy Policy

The United States' progressive income tax system retards skill formation. Tax rules in the United States also tend to promote human capital formation over physical capital formation (Quigley and Smolensky 1990). There is some evidence that U.S. tax laws are more favorable toward investment by more-skilled and wealthier workers, although there are elements in the tax code that favor low-skilled workers as well. U.S. tax rules also tend to encourage investments made on the job over investments in formal schooling, especially schooling that

requires substantial out-of-pocket or tuition costs. Although many of the effects of the current tax system on human capital investment may be unintended, they may nevertheless be substantial and may favor certain workers as well as certain types of investment over others.

To understand how taxes influence human capital investment, it is helpful to understand the costs of and returns to such investment. The costs of investment in human capital are foregone earnings net of taxes plus any additional tuition or out-of-pocket expenses. Higher proportional taxes reduce the costs of spending an hour in school by the amount they reduce the return of working an hour in the market.

The simplest case to consider is a regime with flat (proportional) taxes in which the only human capital investment cost is foregone income. In this case, changes in the level of the flat wage tax will have no effect on human capital accumulation. Increases in the tax rate reduce the return by the same proportion as they reduce the cost, so there is no change in the incentive to invest. The ratio of marginal returns to marginal costs remains unaffected. Hence, proportional taxes on labor income have no effect on investment in human capital. On the other hand, if there are tuition expenses that are not tax deductible, a higher tax rate discourages investment in human capital, because it lowers the returns to investment more than the costs. In the case of a 10 percent increase in the tax rate, the return to investment decreases by 10 percent, and the cost of foregone income declines by 10 percent, but the tuition cost remains unchanged if tuition cannot be deducted from taxable income. Thus, the return to investment declines by more than the costs, so human capital investment is discouraged.

The intuition behind the neutrality of flat labor income taxes on human capital investment arises from the fact that the cost of time inputs to investment is foregone earnings, which are tax deductible. If tax rates are 10 percent and one earns $10 less, one pays $1 less in taxes–one's net loss is only $9. The costs of other inputs to on-the-job training can

typically be expensed by the workers' employers and can be financed through lower wages, thereby making them tax deductible as well. The only major cost of human capital investment that is not tax deductible is college tuition and there are even more cases, discussed below, where interest on loans for tuition are deductible. Starting in 2002 and through 2005 up to $3,000 (for 2002 and 2003) or $4,000 (for 2004 or 2005) of college tuition is deductible. However, there is a means test so that filers with adjusted gross income above $130,000 do not qualify for the deduction. Although college tuition is a substantial cost for some, a majority of youth do not attend college, and of those who do a majority attend community colleges or state colleges where tuition costs are modest. Because most of the costs of investment are financed through foregone earnings and are tax deductible, changes in the rate of a flat tax on wages will have little effect on human capital accumulation.

In a modern society, in which human capital is a larger component of wealth than is land, a proportional tax on human capital is like a nondistorting Henry George tax as long as labor supply responses are negligible. Estimated intertemporal labor supply elasticities are small, and welfare effects from labor supply adjustment are negligible. (See the evidence summarized in Browning, Hansen, and Heckman 1999.) Taxes on human capital should be *increased,* whereas taxes on capital should be decreased, to promote wage growth and efficiency.

The current U.S. tax system, however, is not flat. The progressiveness in the tax schedule discourages human capital investment. The gain in earnings resulting from human capital investment causes some individuals to move up into a higher tax bracket. for such individuals, the returns from investment are taxed at a higher rate, but the cost is expensed at a lower rate. This discourages human capital accumulation. Consider a progressive tax system in which the only cost of investment is foregone earnings. Suppose an individual's current marginal tax rate is 10 percent. Suppose also that if he or she chooses to invest, his or

her increased earnings will cause him or her to switch to a marginal tax rate of 20 percent. In this case the returns are taxed at the 20 percent level, but the costs are deducted at the 10 percent level, and progressive taxes discourage human capital investment when compared to a flat tax regime.

Taxes on physical capital are another important component of the tax system that can affect human capital investment decisions. The level of human capital investment declines when the after-tax interest rate increases, because the discounted returns to investment are then lower. Reducing the tax on interest income can have a beneficial effect both on capital accumulation and on real wages.

Heckman, Lochner, and Taber (1998b, 2000) and Heckman (2001), estimate that for the U.S. economy, a revenue-neutral move to a flat tax on consumption in the steady state would raise the wages of both skilled and unskilled workers and raise aggregate output by 5 percent (and aggregate consumption by 3.7 percent) while raising the wages of college graduates and high school graduates equally (7 percent). Such a move would barely affect overall inequality in earnings while promoting the accumulation of greater levels of both human capital and physical capital.[42] The major effect of such a reform, however, would be on physical capital and its feedback effects on wages through the increased productivity of labor. It would have only a small effect on human capital accumulation. Tilting the bias in the tax system toward capital and away from human capital would improve the earnings of both capital and labor in the long run. Low-ability and unskilled members of the current generation would not benefit from a switch to a flat tax. Most ability types would benefit from a flat consumption tax. Heckman (2001) shows that both types of reform are more popular in a period of skill-biased technical change, because tax reform facilitates transition to the new, higher skilled equilibrium.

Reforms to tax policy on interest income are either ignored or misrepresented in

popular discussions. Populists see such a move as favoring capital and hence rich people. They ignore the crucial point that higher levels of capital stocks raise the wages of all workers in a roughly uniform way.

Heckman, Lochner, and Taber (1998b, 2000) show that revenue-neutral movements to a flat income tax have more modest effects on wages than those produced by a consumption tax and only small effects on human capital accumulation. Based on simulations performed by these researchers, one cannot expect tax reform to substantially change human capital stocks, but a move to flat consumption tax will improve welfare.

We next consider which individuals are encouraged to invest by the current tax system and what types of investment they are encouraged to undertake. Various features of the current tax code are biased toward more-skilled workers with higher earnings. For individuals who are employed, human capital investment costs are typically financed through foregone earnings. To the extent that formal educational expenses are not paid for in this way, they can be deducted from gross earnings provided that they are itemized and that itemizations from all sources exceed 2 percent of adjusted gross income. This feature of the tax code tends to favor high-skilled individuals, who are more likely earn higher salaries and thus to itemize expenses.

Prior to 1987, all interest on educational loans was fully deductible as consumer interest. The consumer interest deduction was phased out by 1989. This favored children from higher income families who were typically itemizers. Only recently the law has changed. This exclusion can have substantial disincentive effects. Whereas individuals must pay taxes on interest from savings, they cannot deduct the interest they pay on educational loans. Mortgage interest, however, is still deductible. It is possible for families with home equity to take out mortgages to finance their children's education. Again, it is the more skilled and wealthy who are most likely to own homes, so they and their children are hurt less

by a tax policy that allows only mortgage interest to be deducted from taxable income.

The U.S. tax system favors public-schooling investment at the primary and secondary level over investment in private schooling and in any type of postsecondary schooling. Any student can attend public elementary and high schools free, and the costs of those public schools are financed primarily through local and state taxes, which are fully deductible. Neither private school nor most college tuition (until recently) is deductible, however, so the current tax system is biased against college education and private education. Moreover, the level of tuition tends to increase with college quality, so the current tax system discourages students from attending higher-quality universities. Since private-school tuition is not tax deductible, but local taxes are, taxpayers have incentives to set up good public schools in their communities rather than send their children to private schools.

The current tax system favors human capital accumulation on the job versus full-time schooling. Human capital investments can be separated into those undertaken while working (or paid for by the employer) and those taken elsewhere (and paid for by the individual). Current tax laws favor the former over the latter, encouraging individuals to seek training on the job. Virtually all investments made through an employer can be expensed and financed through foregone wages. The employee does not need to itemize deductions to realize this tax benefit.

Educational assistance programs exempt tuition paid by employers from personal income tax, provided the schooling is job-related. Firms can sell portable vocational or employer-based training to employees and pay for it through lower wages. The foregone earnings are essentially written off on personal income taxes. The tax laws therefore encourage individuals seeking training to look to their employer for that training rather than formal schools. In addition, firms can write off immediately up to $5,250 per year for each worker in training and schooling expenditures that are not job-related. Tuition support,

however, was restricted to undergraduate level education (Joint Committee on Taxation 1992) until 2001 after which time graduate education (e.g., MBA tuition) qualifies.

Relative to investment in physical capital, some types of human capital investment are favored by the tax system, whereas others are not. To the extent that many human capital investments are immediately tax-deductible whereas physical-capital investments must be amortized, the current tax system encourages investment in human capital over investment in physical capital. In cases in which schooling or training costs cannot be deducted (primarily tuition costs for formal schooling) investment in physical capital is favored. Although which groups current tax provisions benefit most (the most or the least skilled) is ambiguous, employer-provided training is certainly favored over training undertaken away from the workplace. This asymmetry of the tax treatment of these two types of training is often justified by the argument that academic education has a much larger consumption value than job-specific training and that this consumption value should be taxed.[43]

Another argument for taxation and subsidy of human capital is the presence of idiosyncratic risk. Judd (2000) shows that under certain conditions on labor supply parameters, riskiness in physical assets, and levels of idiosyncratic risk, there is scope for optimal tax policy *if* idiosyncratic risk is exogenous, that is, if it cannot be affected by individual decisions. To the extent that there is moral hazard, and risk is not exogenous, the scope for optimal tax interventions is more limited. Indeed, if firms can insure workers against the idiosyncratic risk through optimal contracts, there is no scope for government tax or transfer policy, as the market provides efficient risk sharing.[44]

The Problem of the Transition

Skill-biased technical change operates to make workers trained under old regimes obsolete at

prevailing wages in new regimes. This phenomenon operates with a vengeance in transition economies in Eastern Europe and Latin America that have opened up markets and now trade at world prices.

Younger workers trained under old technologies can, and have, adapted to new technologies through retraining and education. For older workers, with more limited horizons and lower levels of skill and ability, such reeducation is not always economically efficient. Displaced American workers in their forties who are offered generous retraining subsidies frequently refuse them, and the return to such training is low (see Heckman, LaLonde, and Smith 1999). Overlapping-generations models with workers of heterogeneous ability and skill reveal that skill-biased technical change creates cohorts of workers with low earning power in the post-change economy (Heckman, Lochner, and Taber 1998b). Their children adapt to the new economy through investments in human capital. In the long run, the economy adjusts to a new, higher level of skill requirements, but the long run can last thirty years or longer and the newly disadvantaged workers pose a serious social and economic problem. As noted above, investment in them is often not economically efficient. Based on the best available evidence, the most economically justified strategy for improving the incomes of low-ability, low-skill adults is to invest more in the highly skilled, tax them, and then redistribute the tax revenues to the poor.

Many people view the work ethic as a basic value, however, and would argue that cultivating a large class of transfer recipients would breed a culture of poverty and helplessness. If value is placed on work as an act of individual dignity, because of general benefits to families, and especially the early environments of young children and because of benefits to communities and society as a whole, then society may be prepared to subsidize inefficient jobs. Increased subsidies to employment induce people to switch out of criminal activities (Lochner 1999). Subsidies induce output that partially offsets the cost of the

subsidy, and so they are a cheaper alternative than welfare (Phelps 1997). The problem with giving such subsidies to adults is that they may discourage skill formation among the young if the subsidies are extended to them (see Heckman, Lochner, and Cossa 2003). To partly alleviate these adverse incentive effects, wage subsidies should be given on a cohort-specific basis. There is evidence that the problem of rising wage inequality is cohort specific (see MaCurdy and Mroz 1995).

Job subsidies, however, are not the same as investment subsidies. The evidence points strongly to the inefficiency of subsidizing the human capital investment of low-skilled, disadvantaged workers.

Migration Policy

As noted by Borjas, Freeman, and Katz (1997) and Borjas (1999), immigration is a substantial contributor to the growth in the low-skilled workforce. Figure 2.2c reveals that in recent years close to 50 percent of all measured high school dropouts have been immigrants. In principle, one can reduce inequality by redirecting migration policy such that only skilled immigrants are permitted to enter the country. One way to do this is to sell entry visas. This would screen out the unskilled.

Given the substantial Mexican representation among the unskilled immigrants to the United States and the country's porous border with Mexico, the feasibility of such a migration policy is far from clear to us. Moreover, different groups benefit and lose from the immigration of unskilled workers. A full accounting of the winners and losers from a migration policy redirected to favor immigration of skilled workers remains to be developed, although migration policy is a potentially promising option to pursue if U.S. borders with Mexico can be secured to enforce immigration restrictions.

Summary and Conclusions

This chapter has presented a framework for thinking about human capital policy. It stresses the need to recognize the dynamic nature of the human capital accumulation process and the multiplicity of actors and institutions that determine human capital investments. It emphasizes heterogeneity in skills, uncertainty about returns, and the need to account for heterogeneity and uncertainty about economic returns in designing policies to foster skill. It stresses the need to conduct cost-benefit analyses to rank proposed policies rigorously.

What has been presented in this chapter is a blueprint for the life cycle analysis of human capital accumulation that requires much further elaboration. There are many gaps in the evidence on life cycle skill formation that need to be filled. A more explicit dynamic theory that accounts for uncertainty is needed to guide future empirical work. When the blueprint presented here is modified and converted into an operational empirical tool, a deeper and more comprehensive approach to the evaluation of human capital policies will be possible.

Because human capital is an investment good, it is important to account for the life cycle dynamics of learning and skill acquisition in devising effective human capital policies. Schooling is only one phase of a lifetime skill accumulation process. Families, firms, and schools all create human capital. Any comprehensive analysis of human capital policy must account for the full range of institutions that produce it.

Learning begets learning because of dynamic complementarities. The empirical evidence presented in this chapter all points in this direction. Recent research has demonstrated the importance of the early years in creating the abilities and motivations that affect learning and foster productivity. Recent research has also demonstrated the importance

of both cognitive and noncognitive skills in the workplace and in the skill acquisition process. Noncognitive skills are a form of human capital and can be produced. Some of the most effective interventions operate on noncognitive skills and motivations. Evidence from dysfunctional families reveals the value of healthy ones.

This chapter has also stressed the need to understand the sources of problems in order to devise effective solutions for them. We have demonstrated the first-order importance of abilities and motivation in producing skills. Cognitive and noncognitive deficits emerge early, before schooling, and if uncorrected, create low-skilled adults. A greater emphasis needs to be placed on family policy. Studies of a limited set of small-scale, high-quality interventions reveal that early cognitive and noncognitive deficits can be partially remedied. The evidence is tantalizing but not definitive.

The traditional approach to human capital policy focuses on schools. But families are just as important as, if not more important than, schools in promoting human capital. The evidence from failed families points to possible benefits from interventions in them. This raises a new set of questions about whether or not society should respect the sanctity of the family in regard to certain dysfunctional groups.

Schools matter. The evidence shows that teachers matter, but that it is difficult to use conventional measures of teacher quality to assess who is a good teacher. Principals and parents know this. Schemes to improve productivity in schools should allow agents to use their local knowledge to create the right incentives. Movement toward choice, competition and local incentives will likely foster productivity in the classroom.

The evidence also shows that education policies based on objective quality measures (class size, teacher salaries, and the like) are unlikely to produce dramatic gains in U.S educational achievement. At current levels of educational support, marginal changes in conventional quality measures yield only modest benefits and often fail a cost-benefit test.

The evidence on credit constraints reveals the unimportance of short-term family income constraints in accounting for the schooling differentials manifest in figures 2.4 and 2.5. Much of the evidence that is alleged to support the existence of widespread credit market problems in the financing of college education is found upon examination to be ambiguous on the existence of such problems. At the same time, we have identified a small group of high school graduates (0 to 8 percent) who are constrained and for whom a targeted transfer policy may be effective. Broadly based policies, like the Hope scholarship program, cut too wide a swath to work effectively. As noted in the chapter, more than 90 percent of Hope's recipients would have gone to college without the program, so it generates massive deadweight.

We have identified heterogeneity and uncertainty of returns as a pervasive feature of human capital investment. Reducing uncertainty has benefits and will improve educational sorting. Targeting the persons who can benefit from interventions will improve the efficiency of those interventions. The trick is in identifying the groups for whom the interventions are likely to be effective. In many human capital programs this has proved to be an elusive goal. Although we have identified that certain types of targeted programs might be effective, much more work on efficient targeting remains to be done.

We have also stressed in this chapter the need to assess carefully the full life cycle stream of the costs and benefits of human capital interventions. Conventional methods of program evaluation frequently ignore costs altogether and are casual about the treatment of benefit duration. For many large-scale interventions, it is essential to account for general-equilibrium effects, which reverse or diminish partial-equilibrium estimates of policy impacts (see Heckman, Lochner, and Taber 1998a, 1998b, 1998c, 2000).

Tax policy is unlikely to be a strong lever to pull to foster human capital development. At the same time, effective tax policy that fosters capital accumulation can have a substantial beneficial effect on wages.

It is important to recognize that all of our discussion in this chapter has involved policies for the American economy, which has a generous subsidy structure for human capital in place. We have considered only changes in policies within the given institutional structure and have not addressed the broader question of whether there should be any subsidization of human capital at all. Many of the same basic principles established in this chapter for the American economy, however, apply more broadly, albeit with different quantitative scales.

It is also important to recognize that most of our analysis in this chapter has focused on gaps, and how to eliminate them, and not on trends. Current understanding of the trends that produce the stagnation in schooling participation rates evident in figure 2.1 is limited.[45] We have already shown that migration of unskilled workers is only a minor contributing factor to this stagnation. We conjecture that the demise of the American family and the growth in single-parent families have contributed to the stagnation. Figure 2.18 shows that over time, an increasing fraction of all U.S. children are growing up in adverse environments. Our analysis in the chapter's second part has revealed the harmful consequences of bad family environments. This explanation for stagnant schooling rates is by itself, however, too simplistic. The trends for failed families show continuing deterioration, whereas the trends in schooling participation are flat. Still, growth in bad family environments is a likely candidate in any scenario that explains figure 2.1. Perhaps the educational response to trends in wage differentials just offsets the educational response to trends in adverse environments. If this conjecture is verified, it reinforces the emphasis on early family policy that we have advocated in this chapter.

Appendix 2A

Rates of Return, Internal Rates of Return, and Discount Rates for Human Capital Investment Programs[46]

Following a well-established tradition, in parts of this chapter, we use the rate of return to compare the productivity of different human capital programs. Many labor economists use the terms *rate of return, internal rate of return (IRR), marginal internal rate of return*, and the coefficient on schooling from a Mincer earnings equation interchangeably, even though these are very distinct concepts. The internal rate of return is usually computed against a null project with no returns or costs. The marginal internal rate of return is computed relative to a "nearby" project using a suitable metric. Heckman, Lochner, and Todd (2001) show the conditions under which a Mincer coefficient is a marginal internal rate of return and reveal that in recent decades these conditions have not been satisfied. The required assumptions on the earnings function of separability between schooling and experience and negligible direct costs are violated in the recent data, so in recent years Mincer coefficients are not reliable estimates of marginal internal rates of return (see also Heckman, Lochner, and Taber 1998a).

It is well known that investment projects chosen according to the highest internal rate of return are not necessarily those with the highest present value. The characteristic feature of many human capital projects, however, is that costs are incurred early in the life cycle, whereas returns are incurred late. Compared to less-costly human capital projects, more-costly projects (e.g., those involving more schooling) yield higher annual returns that occur later but are characterized by a larger and longer stream of upfront costs. When a high-investment and a low-investment human capital project are compared, the differences in the cost-return age pattern are initially negative and then become positive. Payoff streams of

alternative projects cross once. Comparing higher-schooling investment projects with lower-schooling investment projects, a comparison of the marginal internal rate of return with the interest rate on physical capital yields an appropriate decision rule, (i.e., it picks projects with the highest present value as long as there are no credit market imperfections). If the marginal internal rate of return that equates two human capital projects exceeds the rate of interest, the optimal present-value-maximizing policy is to pick the project that requires more human capital investment (Hirschleifer 1970). This feature of human capital investment projects justifies our use of rates of return as a guide to comparing traditional schooling investment policies. At the same time, it is important to recognize that the returns we present apply only to marginal projects. Large scale projects that alter factor prices and returns require a full general-equilibrium analysis (Heckman, Lochner, and Taber 1998a, 1998b, 1998c, 2000).

The common practice of computing an internal rate of return to an investment (compared to no investment) and ranking projects on the basis of this computed return is known to be potentially misleading (Hirschleifer 1970). The project with the highest internal rate of return so constructed can have a lower present value than a rival project. The case when payoff streams cross at several ages is the textbook pathological case. Although it is not empirically relevant for the classical schooling problem, it is highly relevant for comparing policies like job training and preschool policies that have payoff streams that are likely to cross more than once. It is also empirically relevant for comparing returns from human capital investment under uncertainty when there are option values. (Heckman, Lochner, and Todd 2001)

As an example, consider two projects. One is a job training program in which costs are incurred at age 18 and payoffs occur after training but decay rapidly. Figure 2A.1 plots the typical shape of a job training program payoff stream. The other is an enriched preschool program that has the characteristic payoff of an early cost, a long latency period, and payoffs

that begin late and persist. The payoff sequences depicted in the figure cross at multiple ages (6, 19, 25). The internal rate of return for the training program is 25 percent. For the preschool program, it is 7 percent. Yet at a 5 percent interest rate, the net present value for the training program is 13.6, whereas the net present value for the preschool program is 17.3.

This example motivates our use of present values in evaluating alternatives when it is possible to do so. A more general analysis would compute the shadow prices and returns to the full portfolio of human capital investment projects to develop an optimal human capital investment strategy. Setting up the framework to do this is beyond the scope of this chapter. The empirical evidence needed to implement this framework is not yet available.

The question of the appropriate choice of the discount rate to evaluate human capital streams is an old one. It is sometimes argued that human capital projects should be subsidized (or discounted at a rate lower than the market rate) because of idiosyncratic uncertainty that can be collectively eliminated. This argument ignores two key points. First, as noted by Judd (2000), idiosyncratic risk in human capital policy is associated with moral hazard. Private contracts between workers and firms may provide optimal insurance, so there is no role for any government tax or subsidy or for a reduction in the discount rate in evaluating human capital investment projects. Second, as noted by Arrow and Lind (1970), a lower discount rate for government projects is warranted only if all costs and benefits of these projects accrue to the government and can be distributed without cost and without risk among taxpayers. But in the case of human capital projects, individual agents bear the risk unless the government provides full insurance against income risk, which is an infeasible policy given moral-hazard problem. For that reason, it is inappropriate to use a discount rate lower than the market rate for discounting benefits, although it may be appropriate to use a lower discount rate for costs raised from government revenue sources.

Appendix 2B

Auxiliary tables for credit constraints calculations

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Notes

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1 The slowdown in the growth of labor force quality has reduced productivity growth since 1980 by 0.13 percent per year. This has reduced productivity growth by 8 percent (DeLong, Goldin, and Katz 2002).

2 For women, the substantial existing ethnic, racial, and family income gaps did not widen, but they did not shrink either. Secular trends dominate the female time series.

3 Write $H(a)$ as the stock of human capital at age a and $\dot{H}(a)$ as the rate of increase in the human capital stock. Generalizing the celebrated Ben-Porath (1967) model we obtain that human capital production is governed by $\dot{H}(a) = F(H(a), I(s), a),$ where $I(a)$ is the rate of

investment for each age and the stock of human capital and the production function depend on the stage of the life cycle. Dynamic complementarity arises if $\frac{\partial^2 F}{\partial H(a)\partial I(a)'}$ is a positive matrix (all elements are positive).

4 The suggested market failure is somewhat whimsical, since the preferences of the child are formed, in part, by the family into which he or she is born. Ex post, the child may not wish a different family, no matter how poor is his or her family of birth.

5 Evidence on educational responses to tuition subsidies is sometimes mistakenly interpreted as evidence on credit constraints. The purchase of education is governed by the same principles that govern the purchase of other goods: the lower the price, the more likely are people to buy the good. Dynarski (2000) presents recent evidence about the strength of tuition effects on college participation that is consistent with a long line of research. In addition, there is, undoubtedly, a consumption component to education. Families with higher incomes may buy more of the good for their children and may buy higher quality education as well. This will contribute to the relationship displayed in figure 2.4.

6 See BLS (2001) for a description of the NLSY data.

7 Cameron and Heckman condition on an early measure of ability not contaminated by the feedback from schooling to test scores that is documented in Hansen, Heckman, and Mullen (2002).

8 Mulligan (1997) shows that, in the context of a Becker-Tomes model, tuition elasticities for human capital accumulation are greater (in absolute value) for unconstrained people. His proof easily generalizes to more-general preferences (results are available on request from the authors). We present a different argument: by a standard argument in discrete choice, Kane's claim cannot be rigorously established. Let $S = 1$ if $I(t, X) \geq \varepsilon$, where I is an index of net benefit from college, t is tuition, $\frac{\partial I}{\partial t} < 0$ and X are other variables, including income, and ε

is an unobservable psychic-cost's component. Then assuming that ε is independent of t, and X,

$$\Pr(S=1\mid t,X)=\int_{-\infty}^{I(t,X)} f(\varepsilon)\,d\varepsilon,$$

where $f(\varepsilon)$ is the density of psychic costs. Then

$$\frac{\partial \Pr(S=1\mid t,X)}{\partial t}=\left[\frac{\partial I(t,X)}{\partial t}\right] f(I(t,X)).$$

For constrained persons with very low income, $I(t,X)$ is small. Depending on the density of ε, the location of $I(t,X)$ in the support of the density, and the value of $\frac{\partial I(t,X)}{\partial t}$, constrained persons may have larger or smaller tuition responses than unconstrained persons. Thus if ε is normal, and $I(t,X)\longrightarrow -\infty$ for constrained people, if the derivative is bounded, the tuition response is zero for constrained people.

9 Standard errors are not presented in Cameron and Heckman's paper, but test statistics for the hypothesis of equality are.

10 See the note at the base of the table for a complete description of the method used to construct the estimates.

11 These tables have been constructed using the coefficients of the regressions in appendix table B.1. These regressions are described in the note to table 2.2.

12 Work while attending school is studied in Keane and Wolpin (2001). Delay in entry is studied in Kane (1996).

13 The graphs in figures 2.7c to 2.7f have been constructed using the coefficients of the regressions in appendix table B.3. These regressions are described in the caption for figure 2.7.

14 These tables are constructed using the coefficients of the regressions in appendix table

B.2. These regressions are described in the note to table 2.2.

15 We obtain the same empirical patterns reported in the text whether or not we use per capita income measures.

16 The evidence in table 2.3 apparently runs counter to widely cited evidence reported by Duncan and Brooks-Gunn (1997, table 18.3), who show that family income at an early age has a stronger effect on child-completed schooling than family income at later ages. Duncan and Brooks-Gunn do not control for total family income (permanent income). Their evidence does not contradict our evidence. Permanent income is $P = \sum_{t=0}^{18} \frac{1}{(1+r)^t} Y_t$. In a model in which only permanent income mattered ($S = \gamma_0 + \gamma_1 P$) the coefficient on early income entered as a separate regressor would necessarily be larger than the coefficient on later income unless $r = 0$. Controlling for permanent income P (as Duncan and Brooks-Gunn do not), there should be no effect of income receipts at any age if the permanent income model is correct. This is what we find. When we exclude permanent income from the regression in table 2.3 we find strong effects of average income at ages 0 through 5 and weak effects of average income at ages 16 through 18. These results are available on request from the authors.

17 The take-up rate on Pell Grants and Perkins Loans targeted toward students from low-income families is low (Orfield 1992). Many more people are eligible for support than those who claim it. Binding borrowing constraints are not a plausible explanation for the lack of utilization of these potential resources. Kane (1999) suggests that nonmonetary costs of applying for financial aid may be high, especially for low-income people, because the application process is complex. He argues that decreasing these costs may be a more promising avenue for relaxing financing constraints for low-income people than expanding existing programs. He provides no evidence, however, in support of this conjecture. An alternative explanation consistent with our evidence is that many eligible persons perceive

that even with a substantial tuition subsidy, the returns to college education for them are too low to pay for the foregone earnings required to attend school. Risk aversion due to the uncertainty of income flows may also reduce the returns relative to the benefits.

18 Shea splits his sample into children of educated and uneducated parents. He finds an effect of his measure of income on the schooling attainment of the children of the latter. Many interpret this as evidence for short-term credit constraints. Shea's measure of a family's income, however, is an average income over every year the family is sampled, irrespective of the age of the child. It is a long-run measure of permanent income for some families for which data are available over the life cycle of the family and the child and a short-run measure when the sampling process starts in the child's adolescent years. Shea's estimated income effect combines short-run and long-run effects in an uninterpretable fashion and is thus uninformative on the issue of the empirical importance of short-run credit constraints.

19 We first regress the test score on mother's education, mother's AFQT, and broken home at the same age the test is taken. We then rank individuals on the residuals of this regression and construct percentiles. The pictures we present show the average percentile by income group at different ages. Figure 2.10c presents gaps by race. We include family income at the age of the test (as well as the other variables mentioned above) in the regression before taking the residuals and constructing the ranks.

20 Conditioning on a family choice variable is problematic in producing causal relationships. In addition, Fryer and Levitt analyze one of many cardinalizations of the test score and discuss growth in levels of these arbitrary scores as if they had meaning.

21 Again, Phillips et al. choose a particular cardinalization.

22 The Anti-Social score is calculated as an aggregate of the frequency of dishonest, cruel, noncooperative, violent, or disobedient behaviors (BLS 2001). We first rank individuals by

their Anti-Social scores and then construct percentiles. The figures plot average percentiles by income and race groups.

23 We first regress the Anti-Social score on mother's education, mother's AFQT, and broken home at the same age at which the score is measured. We then rank individuals on the residuals of this regression and construct percentiles. The graphs we present show the average percentile by income group at different ages. Figure 2.12c presents gaps by race. We further include family income at the age at which the score is measured in the regression as well as the other variables mentioned above before taking the residuals and constructing the ranks.

24 No meaning can be attached to the absolute levels or growth rates in levels of the test scores, since any monotonic transformation of a test score is still a valid test score. Valid observations can be made, however, about relative ranks within an overall distribution and how they change.

25 When GED holders are counted as dropouts, the U.S. high school dropout rate is found to have increased, rather than decreased, between 1975 and 1998. (See figure 2.3.)

26 For groups other than GED recipients, the rate of illegal and delinquent behavior decreases monotonically as education levels rise.

27 These authors identify counterfactuals by postulating low-dimensional factor models that generate the potential outcomes. They produce evidence that the low-dimensional models fit the data on wages and employment. To extract estimates of uncertainty about returns to schooling, they estimate schooling-decision rules and ascertain which factors that explain future outcomes agents act on when they make their schooling decisions.

28 These gains are measured in terms of present value of earnings over the lifetime. However, when we measure these gains in utils (assuming a log utility function in each year and no borrowing or saving), 39 percent of college graduates earn ex-post negative returns to

college (55 percent of high school graduates would earn negative returns to college had they gone to college).

29 This is a partial equilibrium statement. The return to high school would rise as more people went to college. This would flatten the slope of figure 2.16 as college going increased.

30 They also account for ceiling effects of tests. In their work, they cardinalize the test score.

31 In Hansen, Heckman, and Mullen's paper, latent ability is equated with IQ, which cannot be manipulated after age 10.

32 All dollar values presented here are in 1990 dollars.

33 These calculations were suggested to us by Sam Peltzman. Similar calculations for increasing teacher salaries by 30 percent lead to the same conclusions. The calculations presented here first appear in Heckman and Lochner (2000). Dayanand Manoli updated these estimates under our guidance.

34 Calculations employing a 3 percent productivity growth rate and a 3 percent discount rate are available on request from the authors. We thank Dayanand Manoli for his help with these calculations.

35 Prominent studies include Witte (2000), Peterson and Hassel (1998) and Rouse (1997).

36 Comparison students were matched with participants on the basis of race, gender, school attended, and ninth-grade academic performance.

37 Cameron and Heckman (1993) have shown that a GED commands lower wages than a high school diploma in the labor market.

38 See Granger and Cytron (1998) for a summary of both.

39 See U.S. Department of Labor (1995) for a more comprehensive survey of programs aimed at increasing the skills and earnings of disadvantaged youth.

40 As noted by Kaplow (1996); Sandmo (1998); and Bovenberg and Jacobs (2001), accounting for the perceived marginal social benefit of redistribution sometimes reduces the marginal welfare cost of funds below unity. The exact figure for this marginal cost is a matter of some controversy in the literature.

41 Seven years has been selected as the measure here because Couch (1992) shows that one intensive wage subsidy program has annual benefits of that duration.

42 In order to account for the constancy of capital's share over time in the U.S. economy, they use a Cobb-Douglas (in capital) model, and hence assume no capital-skill complementarity. Although some others claim to find such complementarity, they are hard-pressed to explain the near constancy of the capital share over time. This absence of capital-skill complementarity is the reason for the absence of any substantial effects on earnings inequality from a revenue-neutral move to a consumption tax.

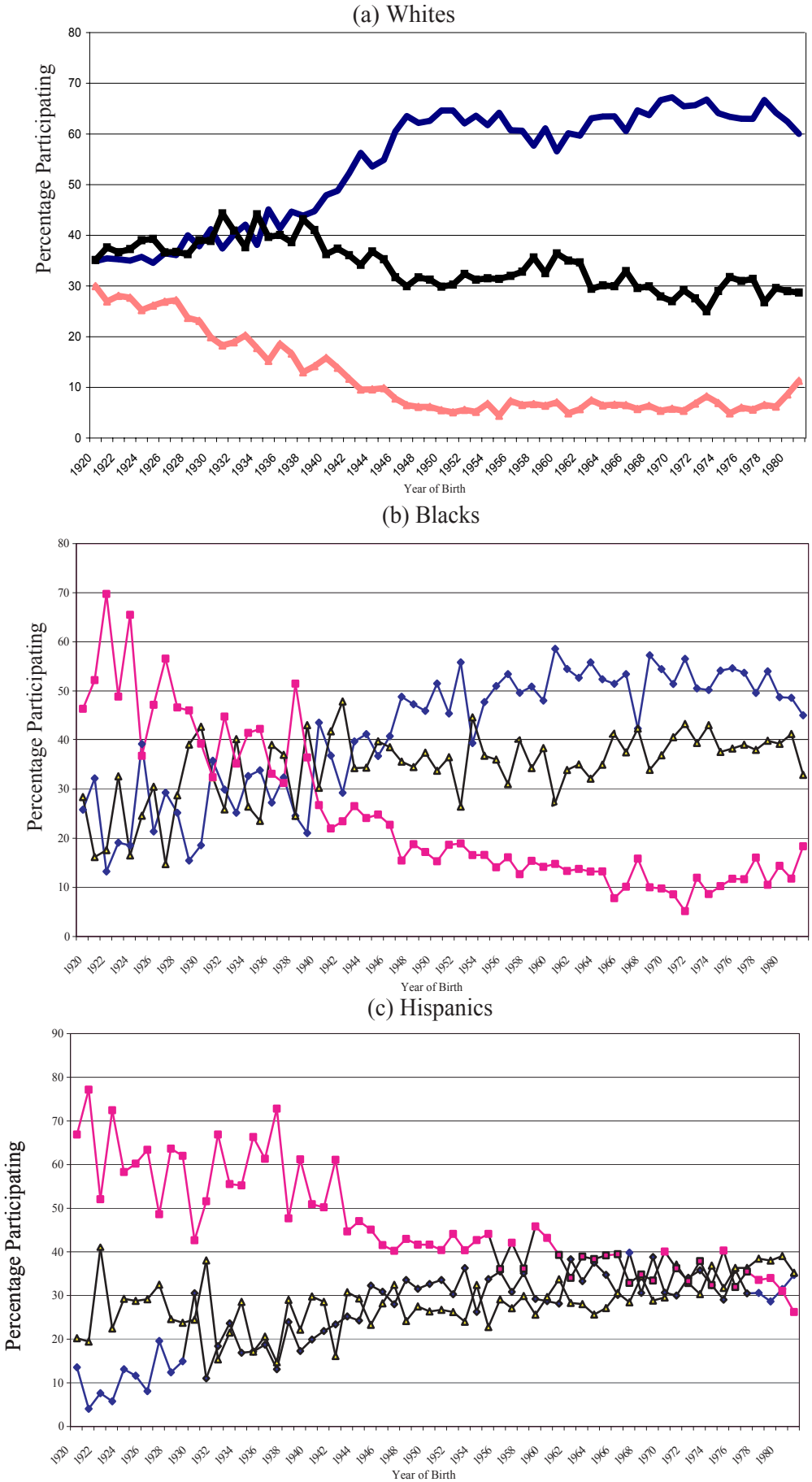
43 This account of the tax system oversimplifies many aspects of reality. A fully rigorous analysis of the bias in the tax system for or against human capital remains to be developed.

44 In his comments on this chapter, Bas Jacobs has acquainted us with his innovative research on optimal tax and subsidy policies. Bovenberg and Jacobs (2001) show that optimal taxes lead to high marginal tax rates for the poor which need to be accompanied by offsetting educational subsidies to avoid distortions in production. A more comprehensive analysis should account for the design of joint tax-subsidy policies that consider both the redistributive benefits of taxation and the productive benefits of education subsidies to offset the distortions on the production of human capital caused by progressive taxation.

45 See the analyses in Card and Lemieux (2000, 2001). Card and Lemieux's explanation of the slowdown in college participation rates and the increase in high school dropout rates using "cohort size" verges on the tautological.

46 This appendix was motivated by the comments of Lawrence Summers at the Harvard debate where this chapter was first presented.

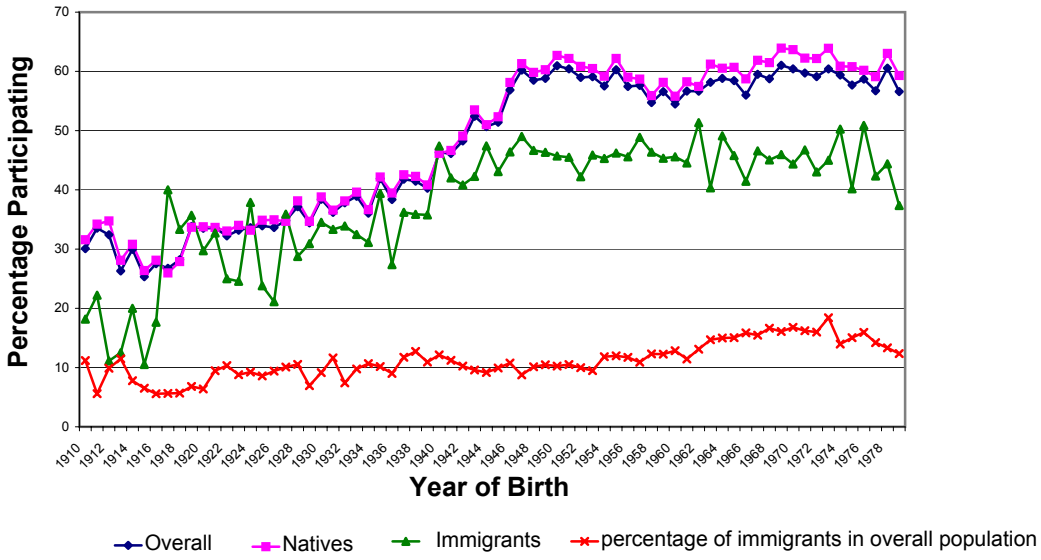
Figure 2.1
Schooling participation rates by year of birth



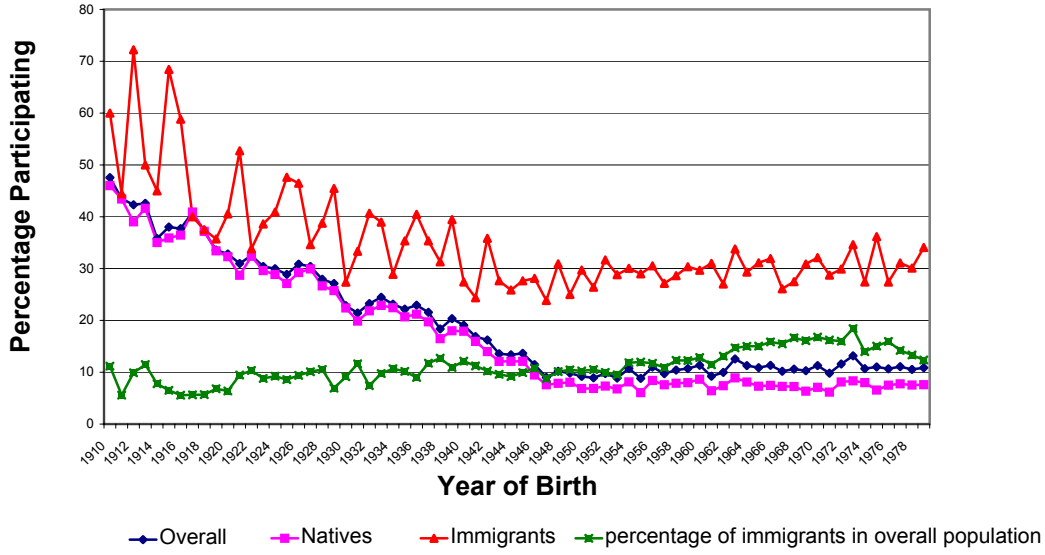
Source: Data from 2000 Current Population Survey

Figure 2.2

(a) College participation rates by year of birth



(b) High school dropout rates (not Including GED holders) by year of birth



(c) Percentage of overall educational participation rates due to immigrants by year of birth

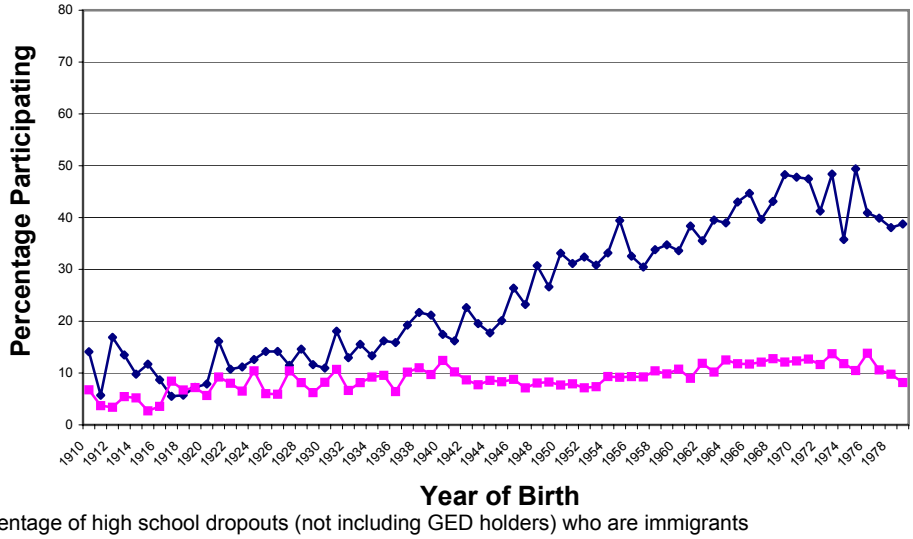
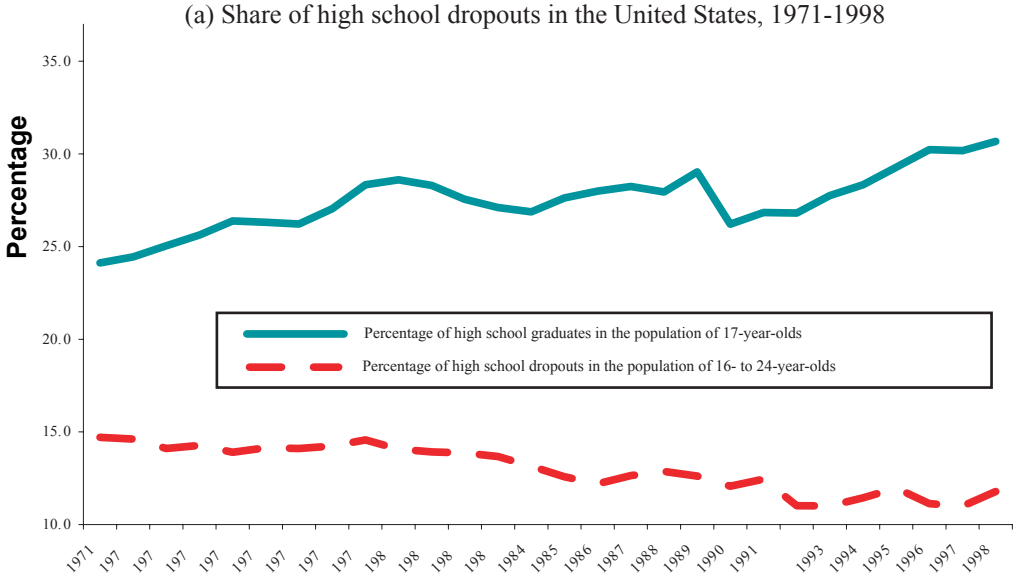
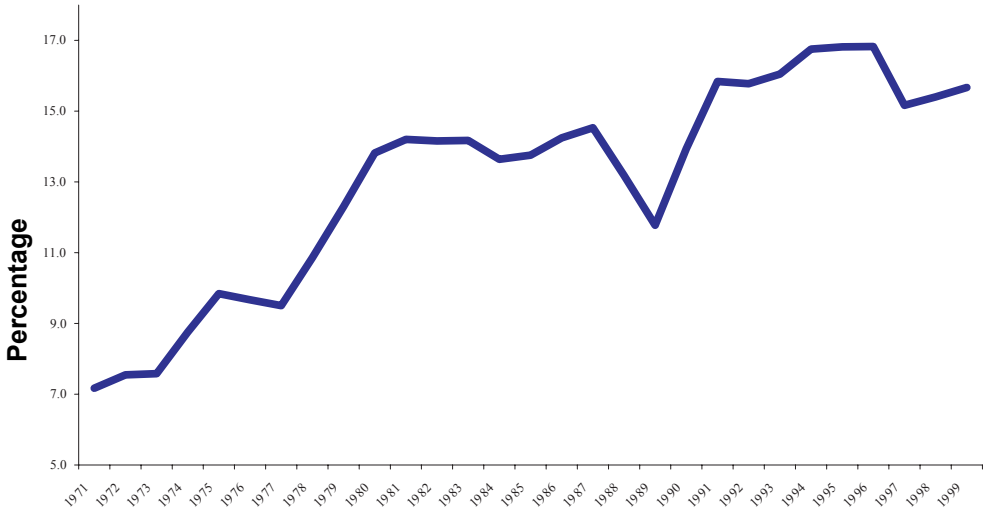


Figure 2.3

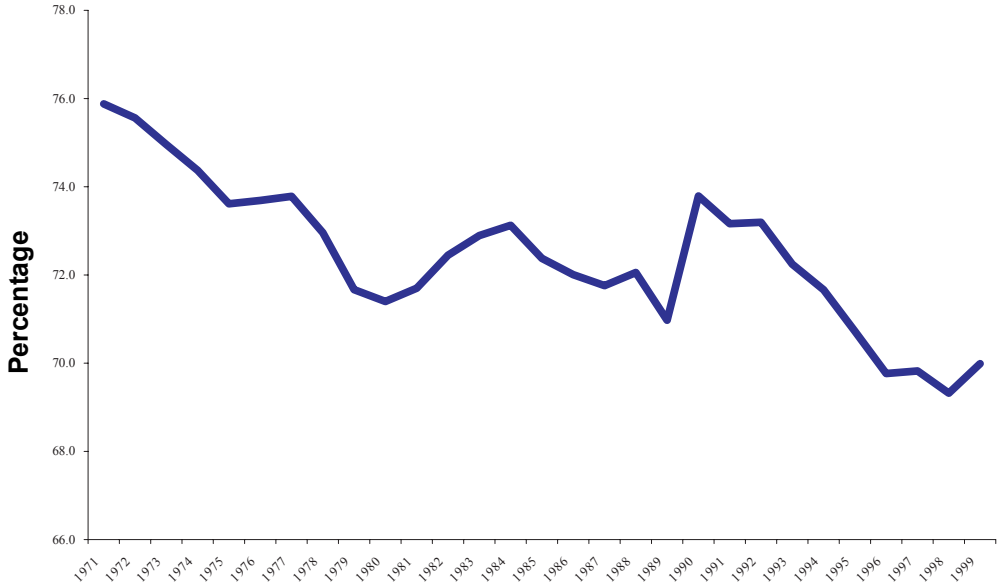
(a) Share of high school dropouts in the United States, 1971-1998



(b) Number of people receiving high school equivalency credentials as a percentage of total high school credentials issued by public schools, private schools and the GED program, United States, 1971- 1999



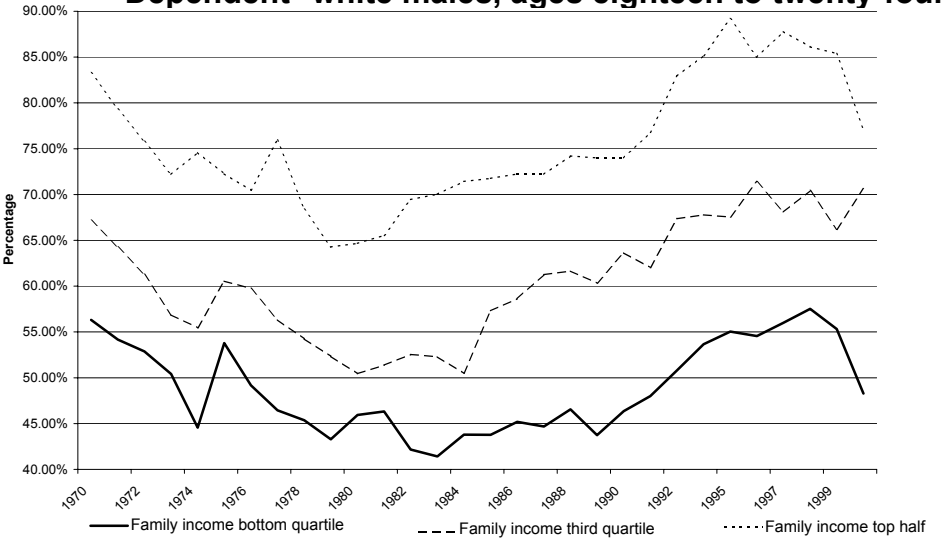
(c) High school graduates of regular day school programs, public and private as a percentage of seventeeen year-old population United States, 1971-1999



Source: Based on data from (1) The Department of Education National Center for Education Statistics and (2) American Council on Education, General Educational Development Testing Service.

Figure 2.4
College participation of high school graduates and GED holders

Dependent* white males, ages eighteen to twenty-four



Source: Computed from the CPS P-20 School Reports and the October CPS.

*Dependent is living at parental home or supported by parental family while at college.

Table 2.1

Effects of $1,000 increase in gross tuition (both two and four year) on the college entry probabilities of high school completers by family income quartile and by AFQT quartile

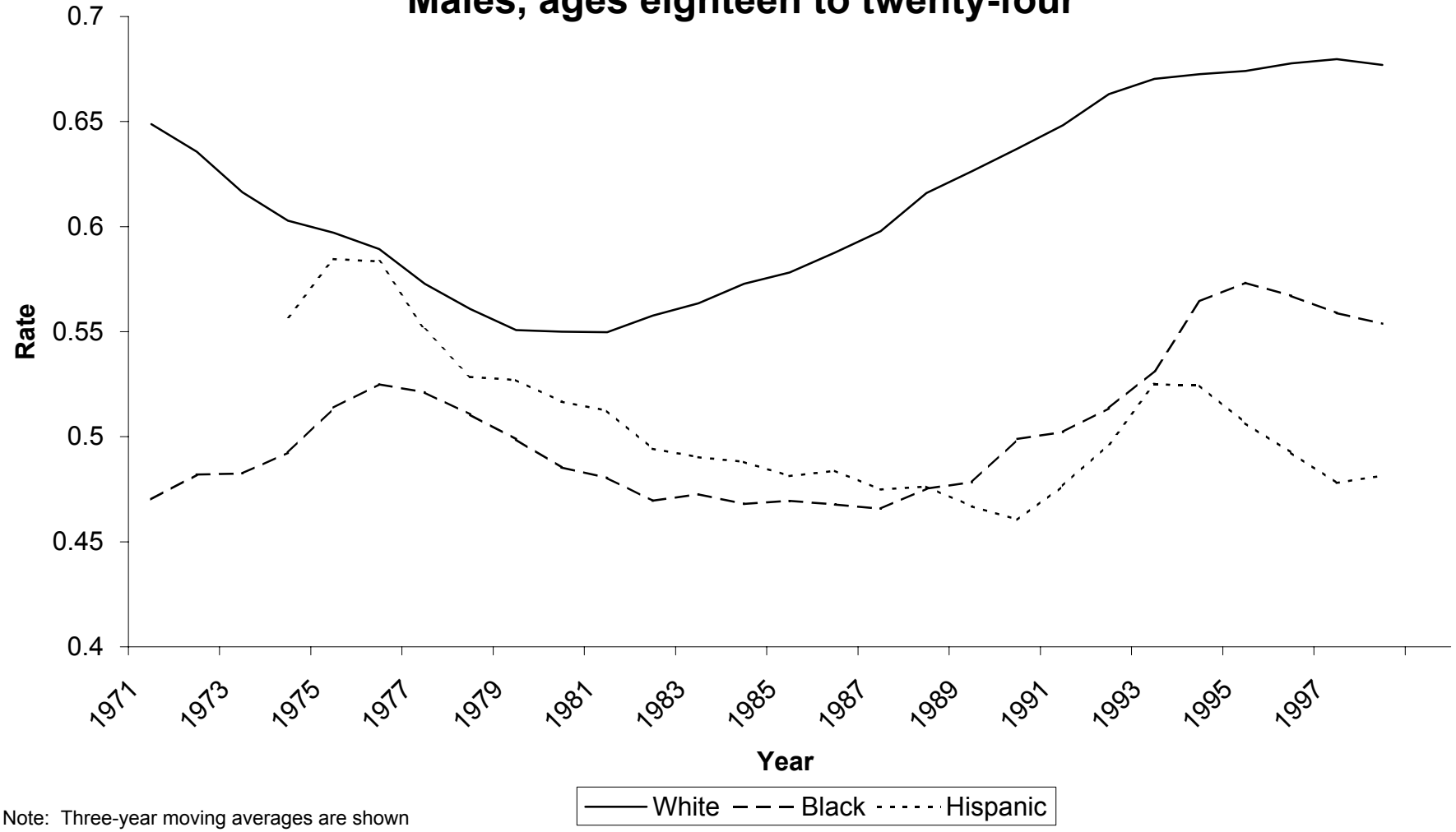
	Whites (1)	Blacks (2)	Hispanics (3)
	A. Overall gross tuition effects		
(1) No explanatory variables except tuition in the model	-.17	-.10	-.10
(2) Baseline specification	-.06	-.04	-.06
(3) Adding AFQT to the row (2) specification	-.05	-.03	-.06
	B. By family income quartiles (panel A, row (2) specification)		
(4) Top quartile	-.04	-.01	-.04
(5) Second quartile	-.06	-.03	-.05
(6) Third quartile	-.07	-.07	-.08
(7) Bottom quartile	-.06	-.05	-.08
(8) Joint test of equal effects Across quartiles (*p*-values)	.49	.23	.66
	C. By family income quartiles (panel A, row (3) specification)		
(9) Top quartile	-.02	-.02	-.02
(10) Second quartile	-.06	.00	-.05
(11) Third quartile	-.07	-.05	-.09
(12) Bottom quartile	-.04	-.04	-.07
(13) Joint test of equal effects Across quartiles (*p*-values)	.34	.45	.49
	D. By AFQT quartiles (panel A, row (3) specification plus tuition-AFQT interaction terms)		
(14) Top quartile	-.03	-.02	-.03
(15) Second quartile	-.06	-.01	-.05
(16) Third quartile	-.06	-.03	-.07
(17) Bottom quartile	-.05	-.03	-.05
(18) Joint test of equal effects Across Quartiles (*p*-values)	.60	.84	.68

Source: Cameron and Heckman (1999).

Notes: Gross tuition is the nominal sticker-price of college and excludes scholarship and loan support. These simulations assume both two-year and four-year college tuition increase by $1,000 for the population of high school completers. The baseline specification used in row (2) of panel A and rows (4) through (7) of panel B includes controls for family background, family income, average wages in the local labor market, tuition at local colleges, controls for urban and southern residence, tuition-family income interactions, estimated Pell grant award eligibility, and dummy variables, that indicate the proximity of two- and four-year colleges. Panel D specification adds AFQT and an AFQT-Tuition interaction to the baseline specification.

Figure 2.5

College participation by race
Dependent high school graduates and GED holders
Males, ages eighteen to twenty-four

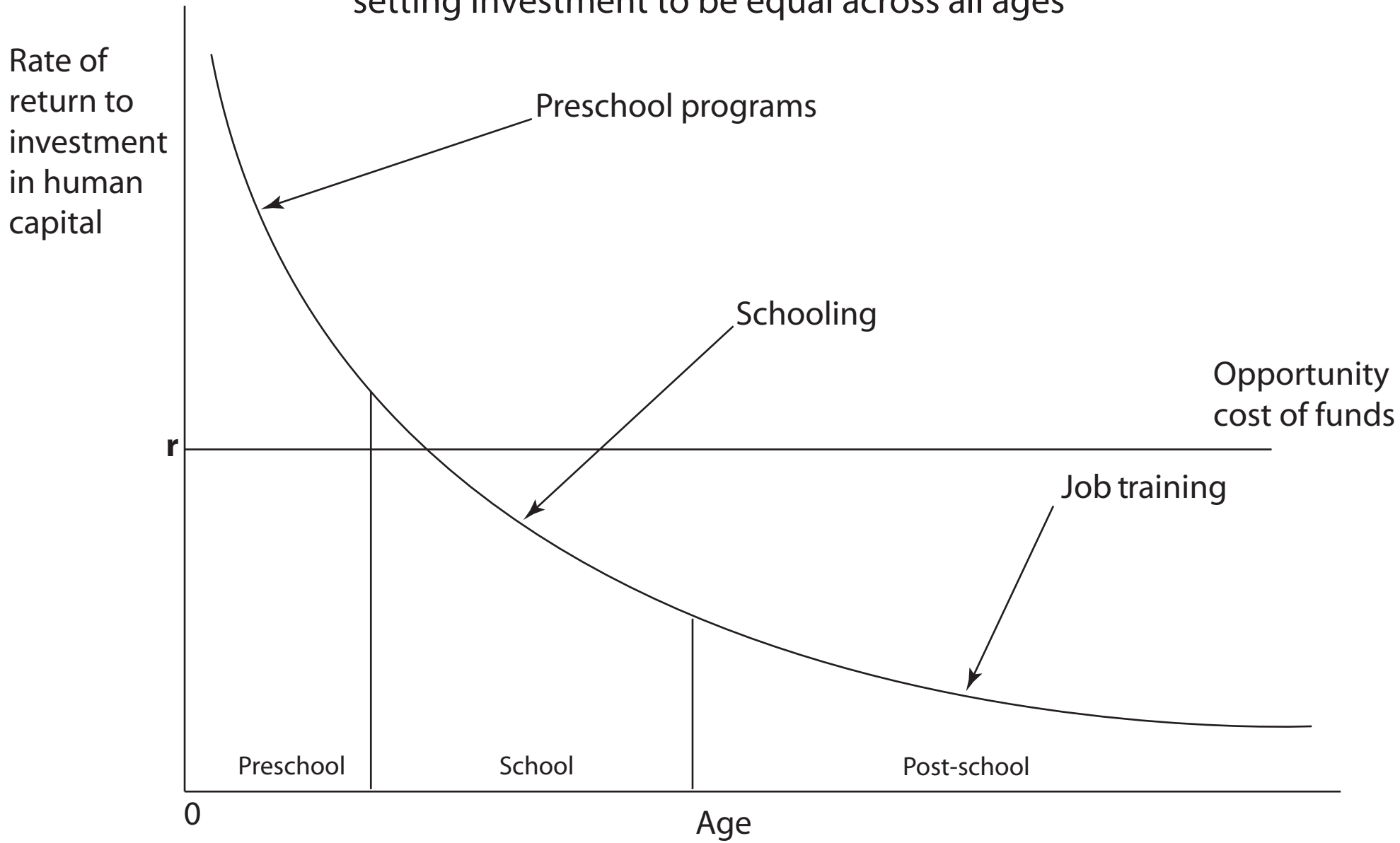


Note: Three-year moving averages are shown

Source: Computed from the CPS P-20 School Reports and the October CPS. □

*Dependent is living at parental home or supported by parental family while at college.□

Figure 2.6
(a) Rates of return to human capital investment initially setting investment to be equal across all ages



Rates of return to human capital investment initially setting investment to be equal across all ages

Figure 2.6
(b) Optimal investment levels

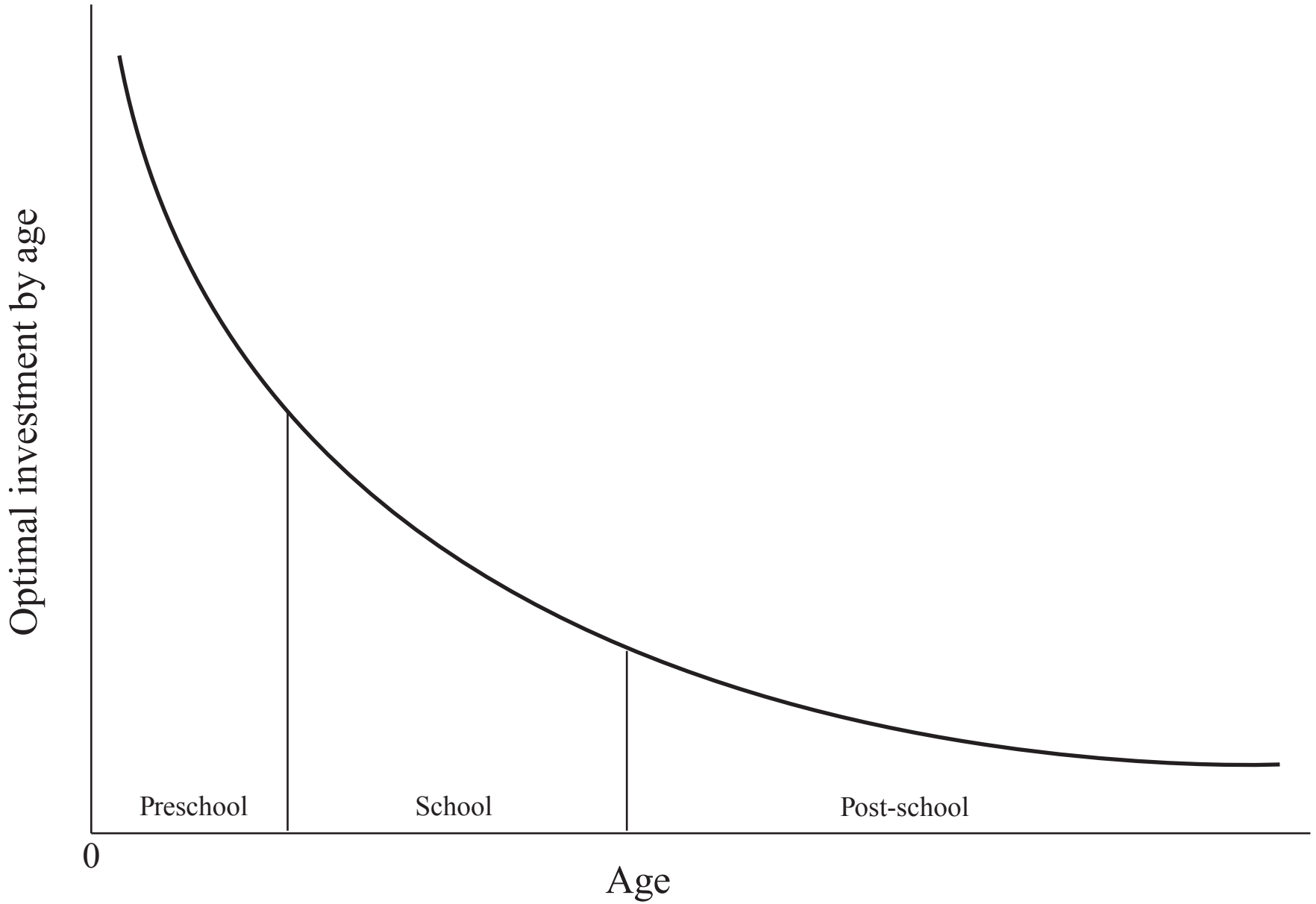


Table 2.2

Adjusted gaps in college participation

A. Percentage of population credit constrained

	White Males	White Females	Black Males	Black Females	Hispanic Males	Hispanic Females	Overall
Enrollment	.0515	.0449	-.0047	.0543	.0433	-.0789	.0419
Complete four year college	-.0621	.0579	-.0612	-.0106	.0910	.0908	-.0438
Complete two year college	.0901	.0436	-.0684	-.0514	.2285	.0680	.0774
Proportion of people not delaying college entry	.0872	-.0197	-.1125	-.1128	.1253	-.0053	.0594
Enrollment in four year versus two year college	.0646	.0491	.1088	.0024	.1229	-.0915	.0587

B. Percentage of the population credit constrained: Only statistically significant gaps

	White Males	White Females	Black Males	Black Females	Hispanic Males	Hispanic Females	Overall
Enrollment	0	.0095	0	.0164	.0278	-.0139	.0018
Complete four year college	-.0545	.0089	-.0596	0	0	0	.0461
Complete two year college	0	0	0	0	0	.0409	.0020
Proportion of people not delaying college entry	.0714	-.0318	-.0190	.0459	.0487	0	.0538
Enrollment in four year versus two year college	.0530	0	0	0	0	-.0451	.0391

C. Percentage of population family constrained

	White Males	White Females	Black Males	Black Females	Hispanic Males	Hispanic Females	Overall
Enrollment	.3123	.3280	.2658	.2420	.3210	.2923	.2623
Complete four year college	.2723	.2338	.1435	.0738	.4950	.0205	.1958
Complete two year college	-.1718	-.0350	-.0763	-.0565	-.1945	.2168	-.0785
Proportion of people not delaying college entry	.1965	.1898	.1910	.0460	.1950	.1360	.1135
Enrollment in four year versus two year college	.0568	.2423	.1643	.1143	.1533	.0738	.1155

D. Percentage of population family constrained: Only statistically significant gaps

	White Males	White Females	Black Males	Black Females	Hispanic Males	Hispanic Females	Overall
Enrollment	.3123	.3280	.2378	.2420	.3210	.2923	.2623
Complete four year college	.2723	.2338	.0960	0	.4950	0	.1958
Complete two year college	-.1408	0	0	0	0	.1678	-.0730
Proportion of people not delaying college entry	.1718	.1328	.1403	0	.1560	0	.1135
Enrollment in four year versus two year college	.0333	.2423	.1350	.0848	.1225	0	.1155

Notes: Credit constraints are measured in the following way. Within each AFQT tertile, we regress enrollment (completion, delay) on quartiles of the distribution of family income at age 17 and family background variables (south, broken, urban, mother's education, father's education): $y = \alpha + \mathbf{F}\gamma + Q_1\beta_1 + Q_2\beta_2 + Q_3\beta_3$, where y is enrollment (completion, delay), $\mathbf{F}$ is a vector of family background variables, Q_1 is a dummy for being in the first quartile of the family income distribution, Q_2 for being in the second and Q_3 for being in the third. Within each AFQT tertile, the percentage of people constrained in each quartile of family income is measured by β_1, β_2 and β_3, which are gaps in average enrollment (completion, delay) between each quartile and the top quartile of the family income. To get the numbers in the table, we multiply the measured gap in enrollment (completion, delay) for each quartile relative to the highest quartile by the percentage of people in that AFQT tertile-family income quartile. Within each AFQT tertile we add over the three bottom quartiles of family income and then add over the three tertiles of AFQT to get the number of credit-constrained people in the population. When computing family constraints we use a family background index that is a linear combination of south, broken, urban, mother's education, father's education, and AFQT. The coefficients for this linear combination are obtained by linearly regressing enrollment (completion, delay) on the variables composing the index. We then construct quartiles of this index. Family constraints are measured in the following way. We regress enrollment (completion, delay) on the family background quartile and family income at age 17: $y = \alpha + Q_1\gamma_1 + Q_2\gamma_2 + Q_3\gamma_3 + Inc17\beta$, where y is enrollment (completion, delay), Q_1 is a dummy for being in the first quartile of the family background index, Q_2 for being in the second and Q_3 for beig in the third, and $Inc17$ is family income at age 17. The percentage of people constrained in each quartile of the family background index is measured by γ_1, γ_2, and γ_3, which are gaps in average enrollment (completion, delay) between each quartile and the top quartile of the family background index. To get the numbers in the table, we multiply the measured gap in enrollment (completion, delay) for each quartile relative to the highest quartile by the percentage of people in that quartile. Then we add over the three bottom quartiles to get the number of family-constrained people in the population. The coefficients for these regressions for white males are presented in the appendix tables 2B.1 and 2B.2. Regression coefficients for the other demographic groups are available on request from the authors.

Table 2.3
Regressions of enrollment in college on per capita permanent income, per capita early income, and per capita late income: children of NLSY

Variable	(1)	(2)	(3)	(4)
Family Income 0-18 (permanent income)	0.3114	0.2752	0.311	0.2645
(Standard error)	(0.0463)	(0.0755)	(0.0613)	(0.0996)
Income 0-5	-	0.0498	-	0.053
(Standard error)		(0.0821)		(0.0877)
Income 16-18	-	-	-0.0005	0.013
(Standard error)			(0.0605)	(0.0645)
PIAT-Math at age 12	0.0074	0.0073	0.0073	0.0073
(Standard error)	(0.0018)	(0.0018)	(0.0018)	(0.0018)
Constant	0.154	0.1521	0.1523	0.1506
(Standard error)	(0.0259)	(0.0261)	(0.0260)	(0.0262)
Observations	863	863	854	854
R^2	.1	.1	.1	.1

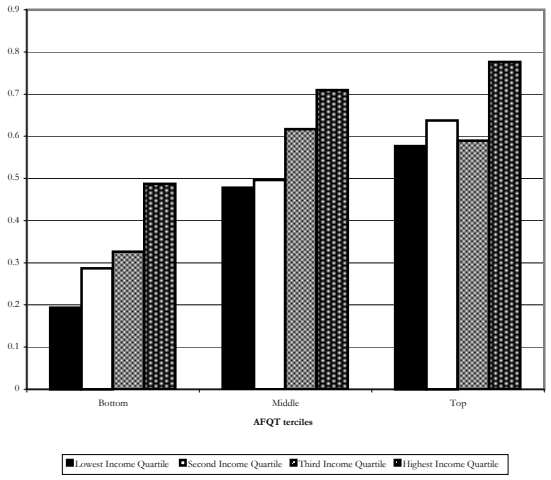
Note: Family income (permanent income) 0-18 is average family income between the ages of 0 and 18. Income 0-5 is average family income between the ages of 0 and 5. Income 16-18 is average family income between the ages of 16 and 18. Income is measured in per capita terms (dividing family income by family size, year by year) in tens of thousands of 1993 dollars. To construct average discounted family income (or permanent income), we used a discount rate of 5 percent. PIAT-Math is a math test score. For details on this sample, see BLS (2001). Let $Y_{i,t}$ be the per capita family income at age t for child i.

Family income 0-18 $= \sum_{t=0}^{18} \frac{Y_{i,t}}{(1+r)^t} \cdot \frac{\frac{1}{1+r}-1}{\left(\frac{1}{1+r}\right)^{19}-1}$, resources in present value terms over the life of the child, where r is the interest rate $= .05$. Income 0-5 $= \sum_{t=0}^{5} \frac{Y_{i,t}}{(1+r)^t} \cdot \frac{\frac{1}{1+r}-1}{\left(\frac{1}{1+r}\right)^{6}-1}$.

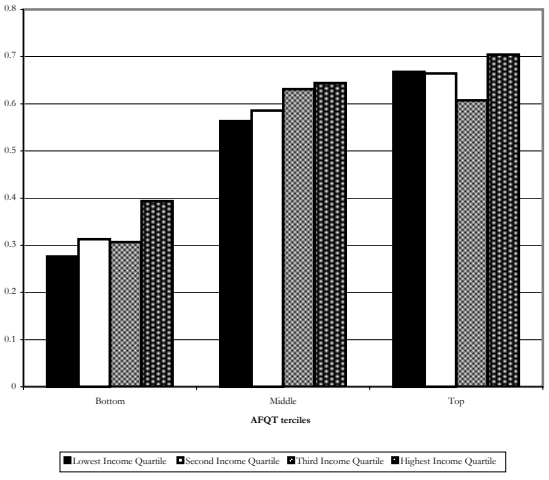
Income 16-18 $= \frac{1}{(1+r)^{15}} \sum_{t=16}^{18} \frac{Y_{i,t}}{(1+r)^t} \cdot \frac{\frac{1}{1+r}-1}{\left(\frac{1}{1+r}\right)^{3}-1}$.

Figure 2.7
Enrollment, Completion and No Delay Rates by Family Income Quartiles and Age-Adjusted AFQT Terciles
White Males, NLSY79

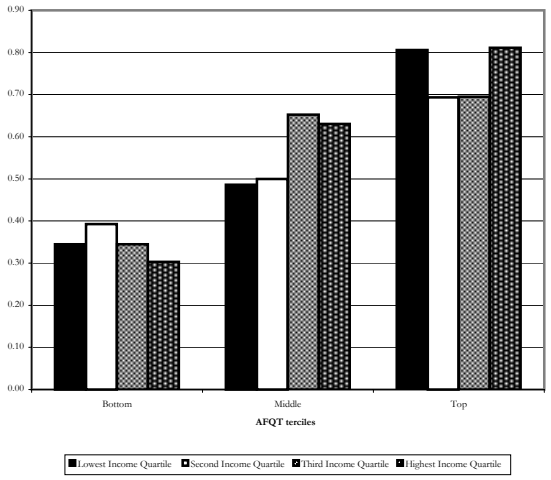
(a) Percentage enrolled in two year and four year colleges



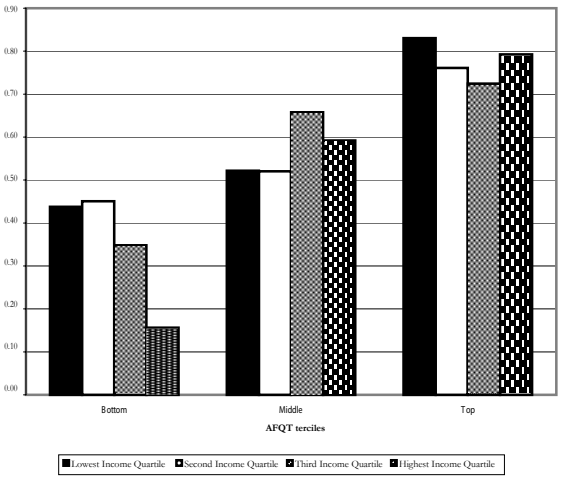
(b) Adjusted percentage enrolled in two year and four year colleges



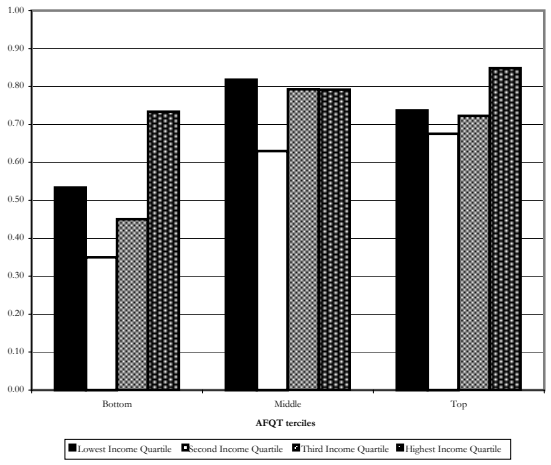
(c) Four year college completion rate



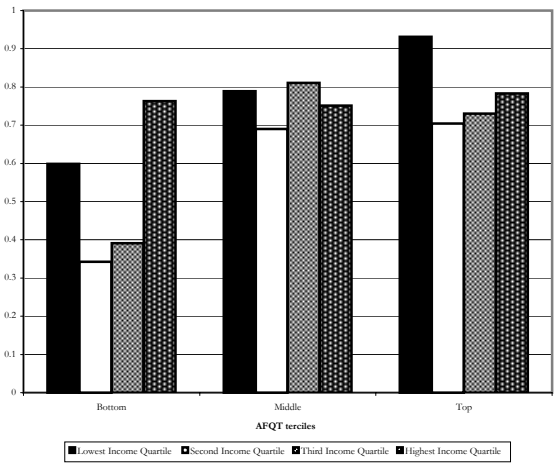
(d) Adjusted four year college completion rate



(e) Percentage with no delay in college entry



(f) Adjusted percentage with no delay in college entry



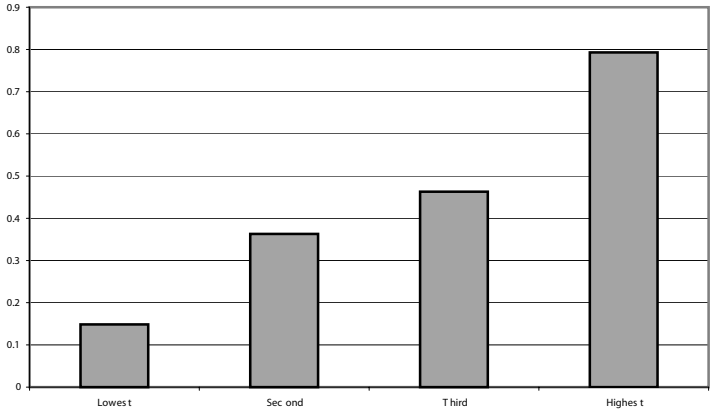
Note: To draw these graphs we performed the following steps. 1) Within each AFQT tercile, we regress percentage enrolled, completion rate, and percentage with no delay on family background: $y = \alpha + F\gamma + Q_1\beta_1 + Q_2\beta_2 + Q_3\beta_3$, where y is percentage enrolled, completion rate, or percentage with no delay, F is a vector of family background variables (southern origin, broken home, urban origin, mother's education and father's education), Q_1 is a dummy for being in the first quartile of the distribution of family income at 17, Q_2 is for being in the second quartile and Q_3 is for being in the third quartile. 2) Then, within each AFQT tercile, the height of the first bar is given by $\alpha + \bar{F}\gamma + \beta_1$, the second is given by $\alpha + \bar{F}\gamma + \beta_2$, the third by $\alpha + \bar{F}\gamma + \beta_3$ and the fourth by $\alpha + \bar{F}\gamma$ (where $\bar{F}$ is a vector of the mean values for the variables in F). The coefficients for the regression are given in the appendix table 2B.3.

Figure 2.8

Enrollment, Completion and Delay by Family Background - AFQT Quartiles

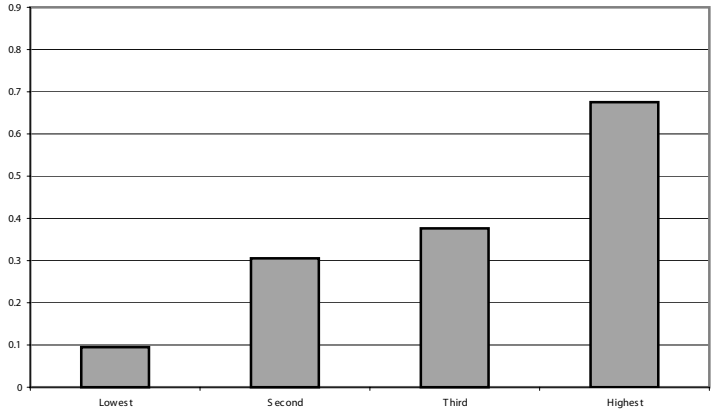
NLSY79 White Males

(a) Enrollment



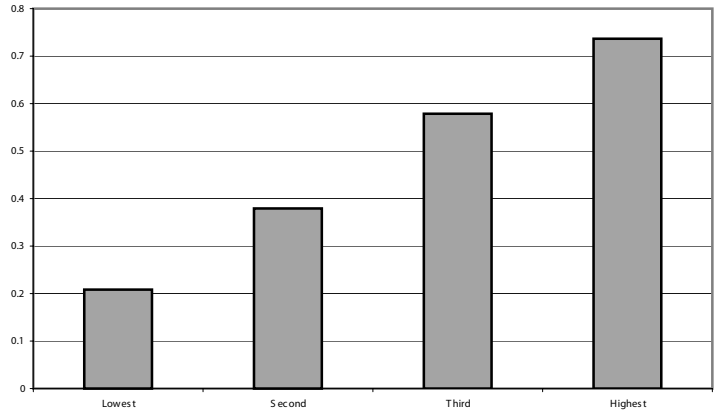
Family background - AFQT quartile

(b) Adjusted enrollment



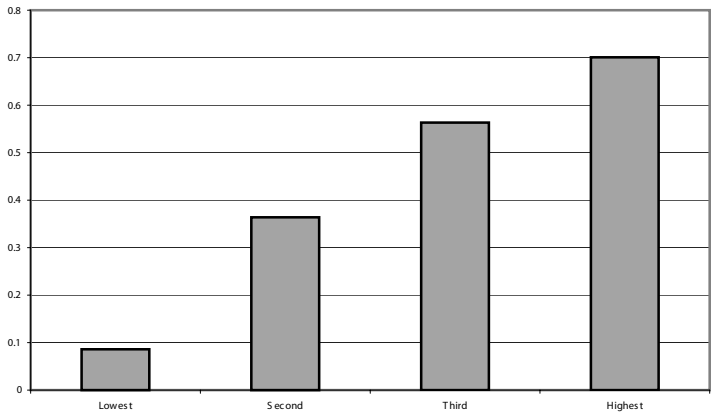
Family background - AFQT quartile

(c) Completion of four year college



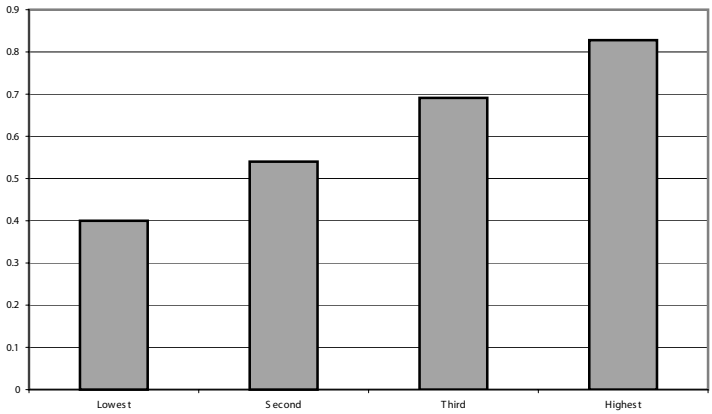
Family background - AFQT quartile

(d) Adjusted completion of four year college



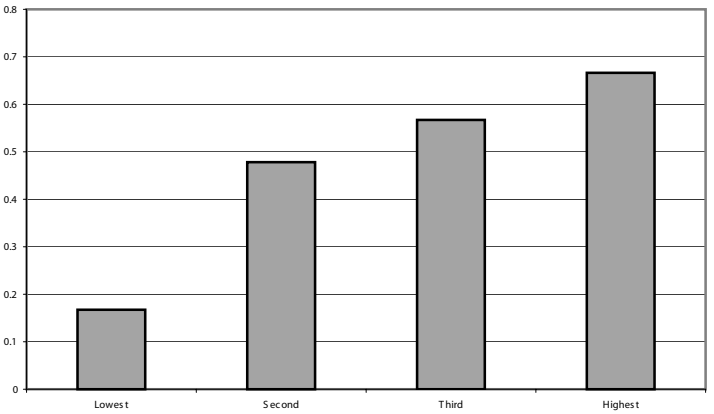
Family background - AFQT quartile

(e) Proportion not delaying college entry



Family background - AFQT quartile

(f) Adjusted proportion not delaying college entry

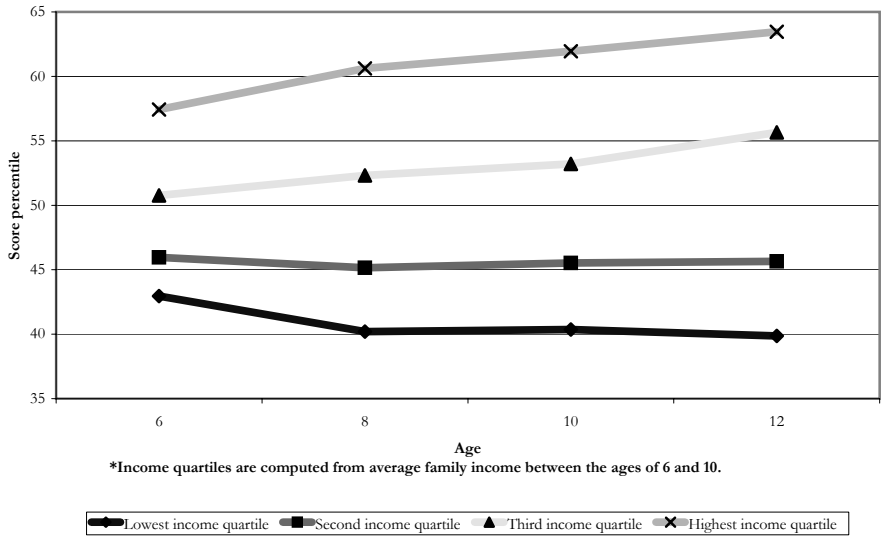


Family background - AFQT quartile

We correct for the effect of schooling at the test date on AFQT. The family background-AFQT index is based on a linear combination of south, broken home, urban, mother's education, father's education and AFQT. For the residual plots, we condition on family income at age 17. See table B.2.4 in the appendix for the coefficients of the linear combination of the variables forming this index.

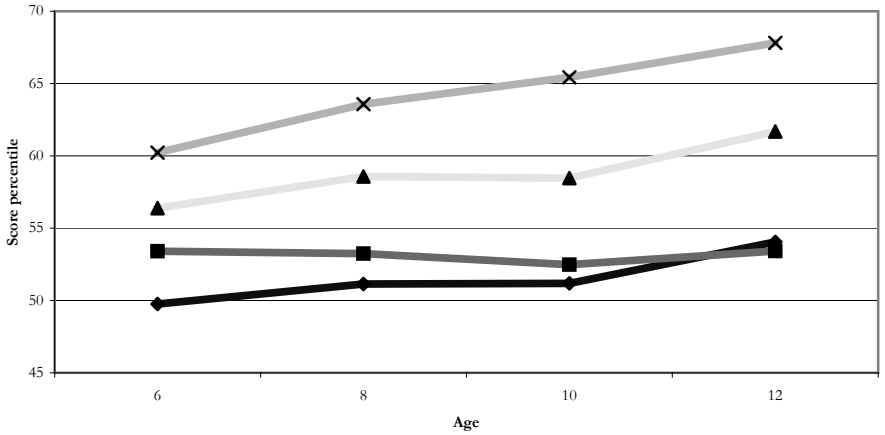
Figure 2.9
Children of NLSY

(a) Average percentile rank on PIAT-Math score, by income quartile*

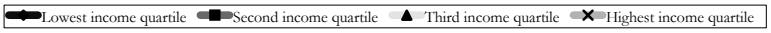


***Income quartiles are computed from average family income between the ages of 6 and 10.**

(b) Average percentile rank on PIAT-Math score, by income quartile*
Whites only



***Income quartiles are computed from average family income between the ages of 6 and 10.**



(c) Average percentile rank on PIAT-Math score, by race

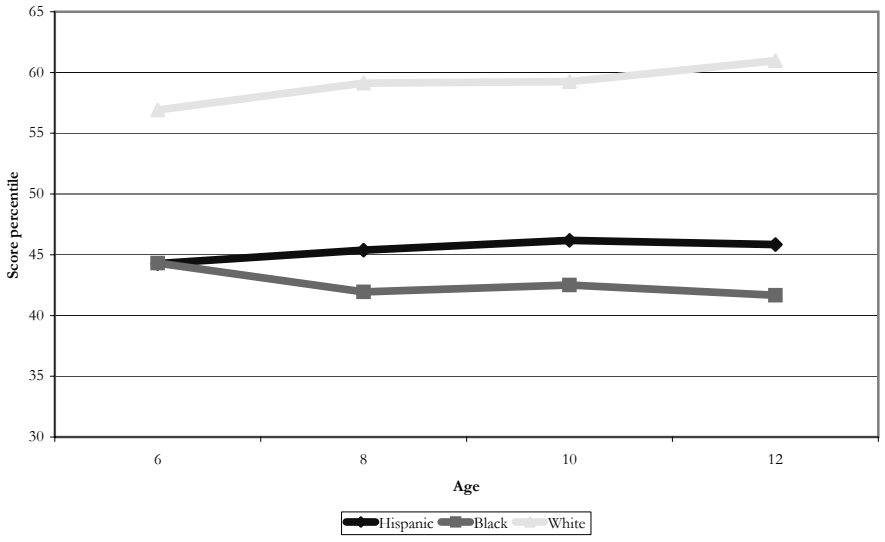
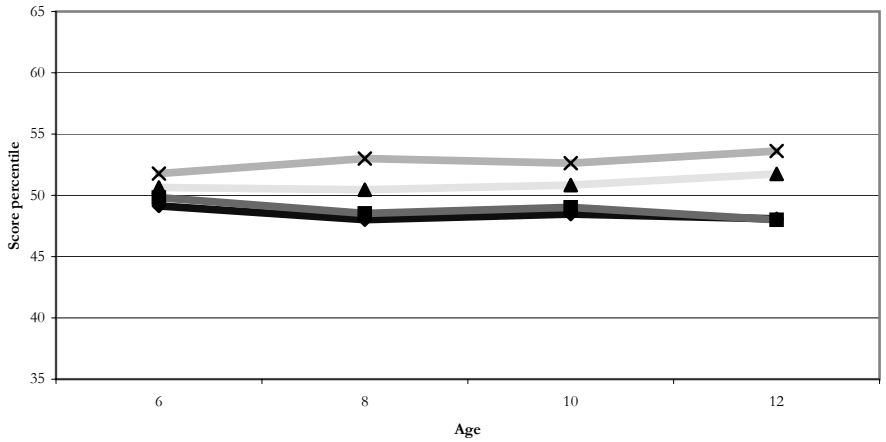
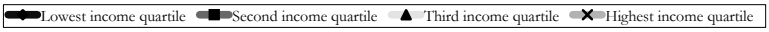


Figure 2.10
Children of NLSY

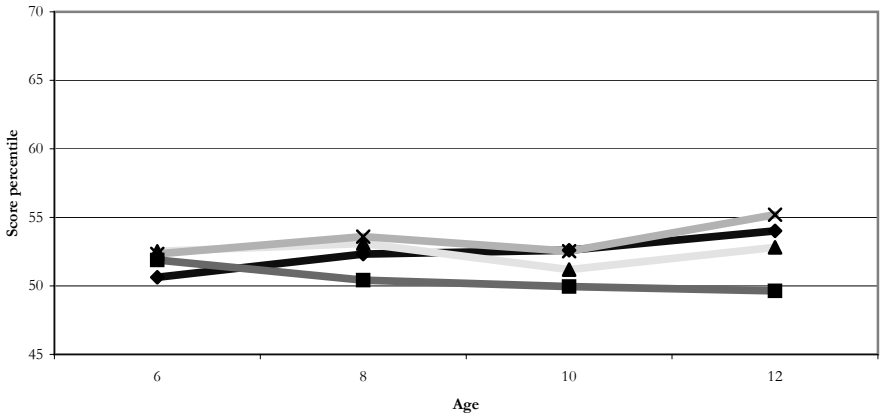
(a) Residualized average PIAT-Math score percentiles by income quartile*



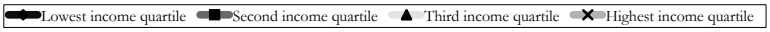
***Residualized on maternal education, maternal AFQT (corrected for the effect of schooling) and broken home at each age.**



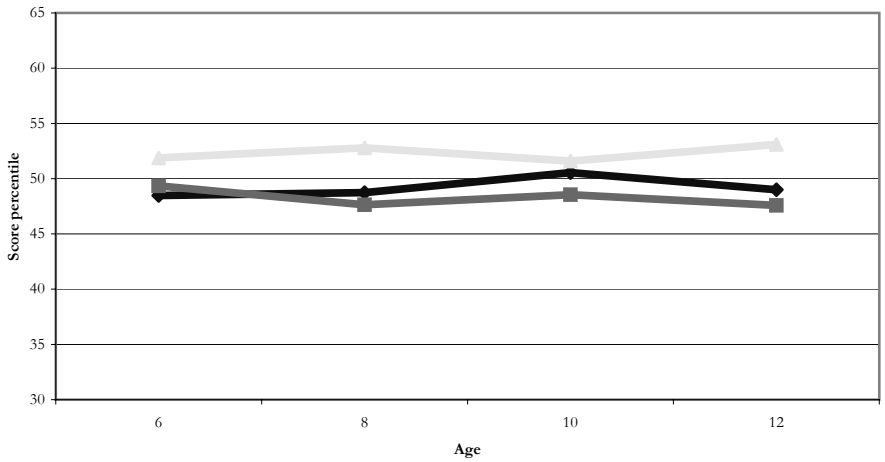
(b) Residualized average PIAT-Math score percentiles by income quartile*
Whites only



***Residualized on maternal education, maternal AFQT (corrected for the effect of schooling) and broken home at each age.**



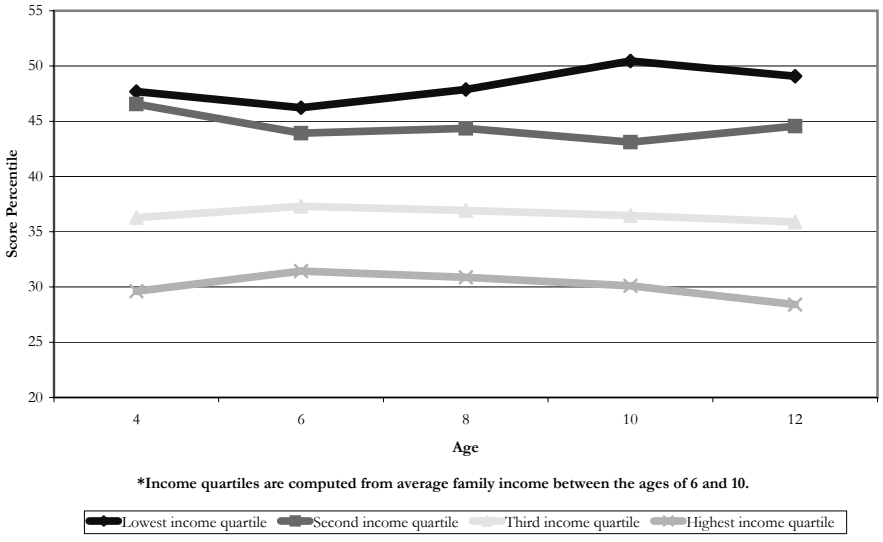
(c) Residualized average PIAT-Math score percentile by race*



***Residualized on maternal education, maternal AFQT (corrected for the effect of schooling) and broken home at each age and family income at each age.**

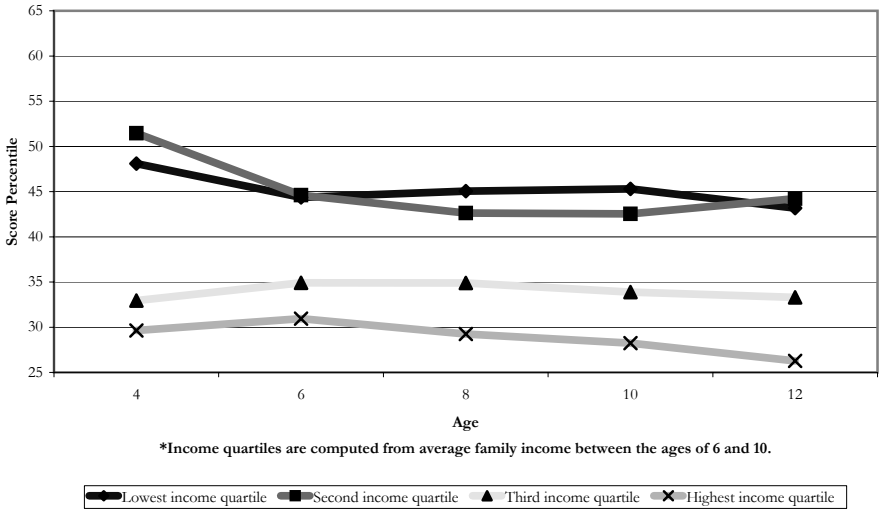
Figure 2.11
Children of NLSY

(a) Average percentile rank on anti-social score, by income quartile*



***Income quartiles are computed from average family income between the ages of 6 and 10.**

(b) Average percentile rank on anti-social score, by income quartile*
Whites only



***Income quartiles are computed from average family income between the ages of 6 and 10.**

(c) Average percentile rank on anti-social score, by race

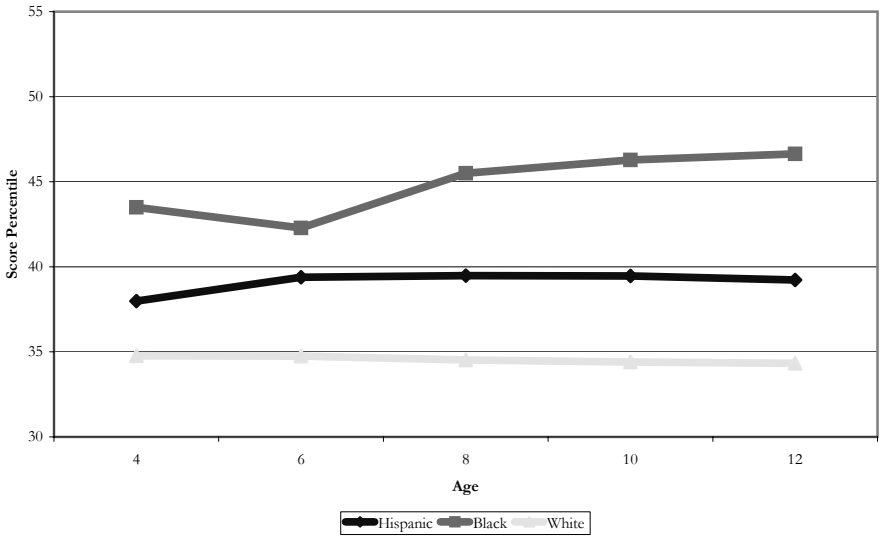
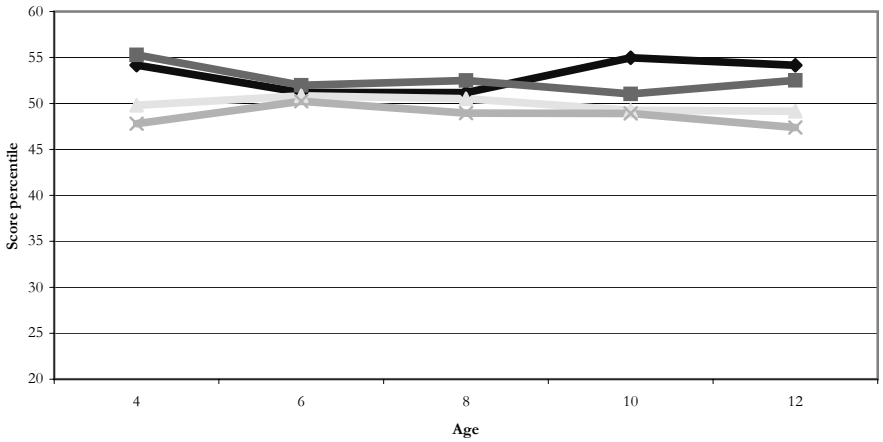
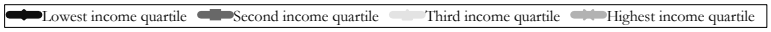


Figure 2.12
Children of NLSY

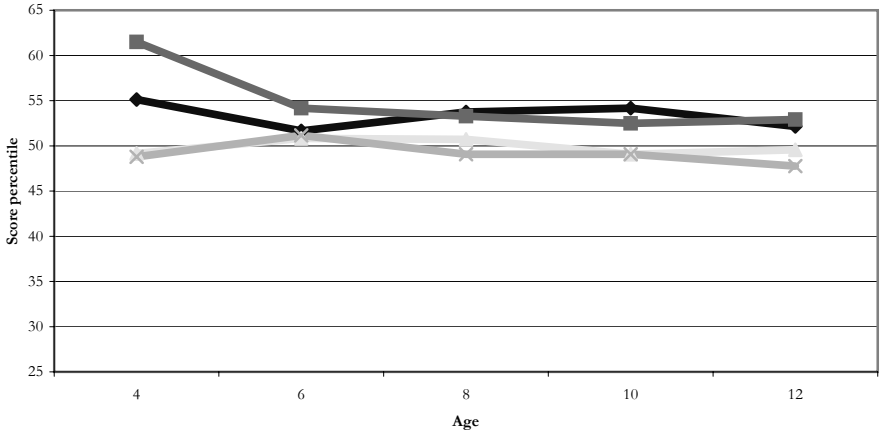
(a) Residualized average anti-social score percentile by income quartile*



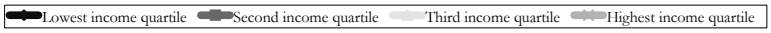
***Residualized on maternal education, maternal AFQT (corrected for the effect of schooling), broken home at each age.**



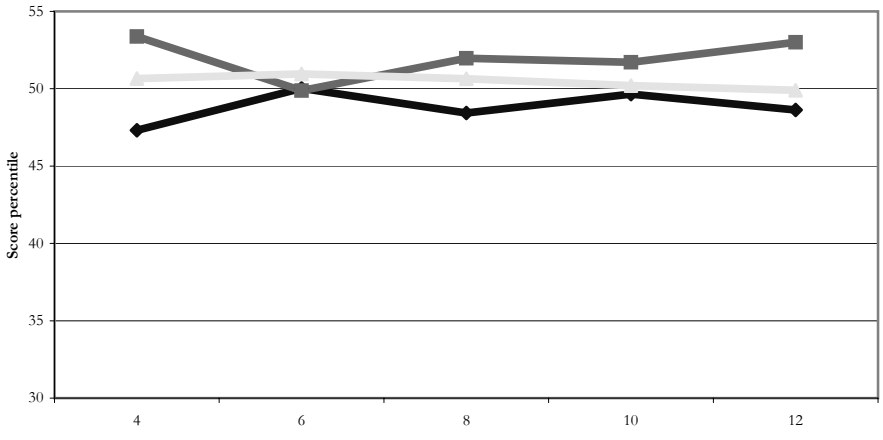
(b) Residualized average anti-social score percentile by income quartile*
Whites only



***Residualized on maternal education, maternal AFQT (corrected for the effect of schooling), broken home at each age.**



(c) Residualized average anti-social score percentile by race*



***Residualized on maternal education, maternal AFQT (corrected for the effect of schooling), family income at each age and broken home at each age.**

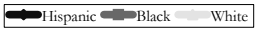
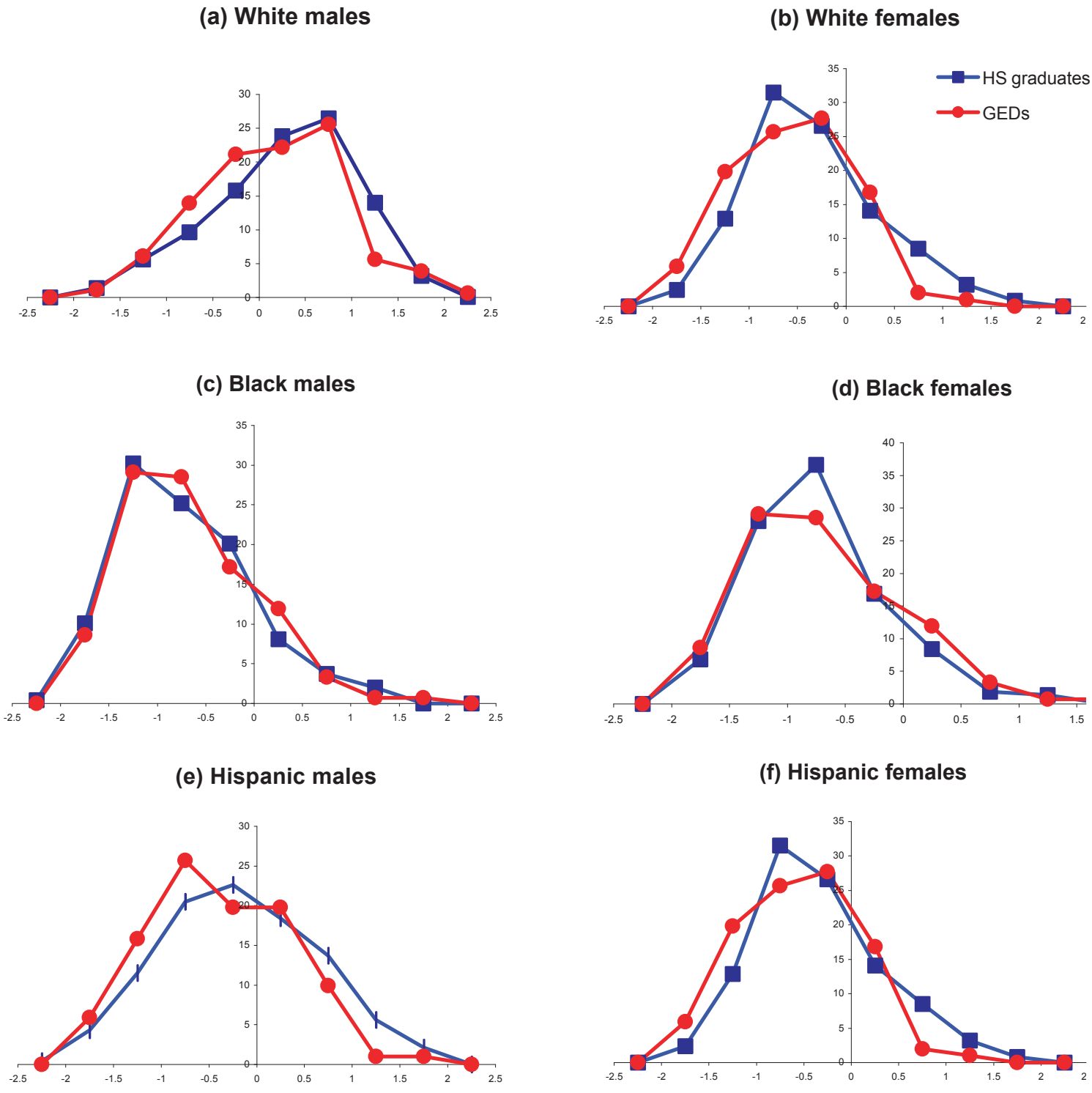
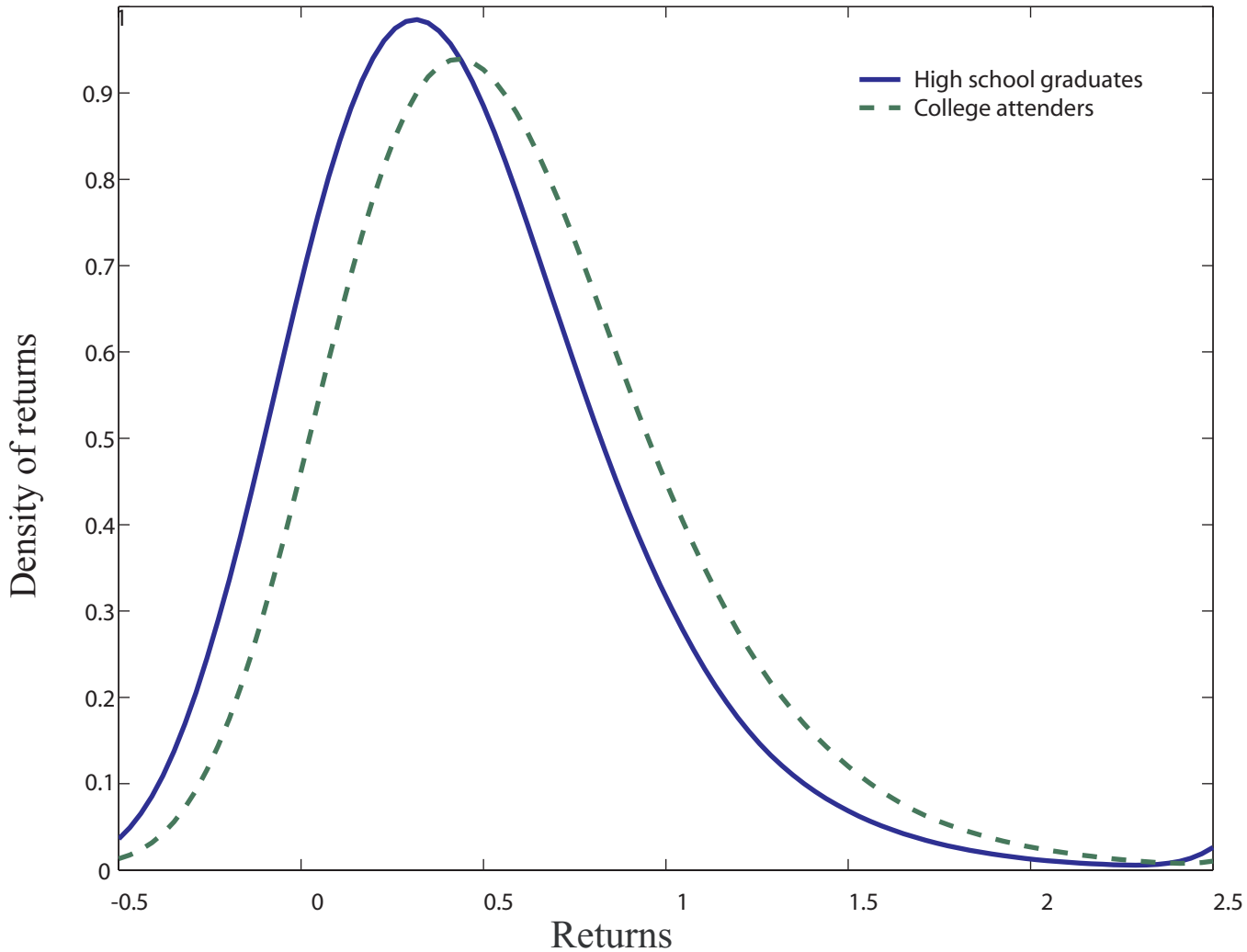


Figure 2.13
Density of age adjusted AFQT scores,
GED recipients and high school graduates with twelve years of schooling



Source: Heckman, Hsee and Rubinstein (2001).

Figure 2.14
Distribution of returns to college versus high school
NLSY79

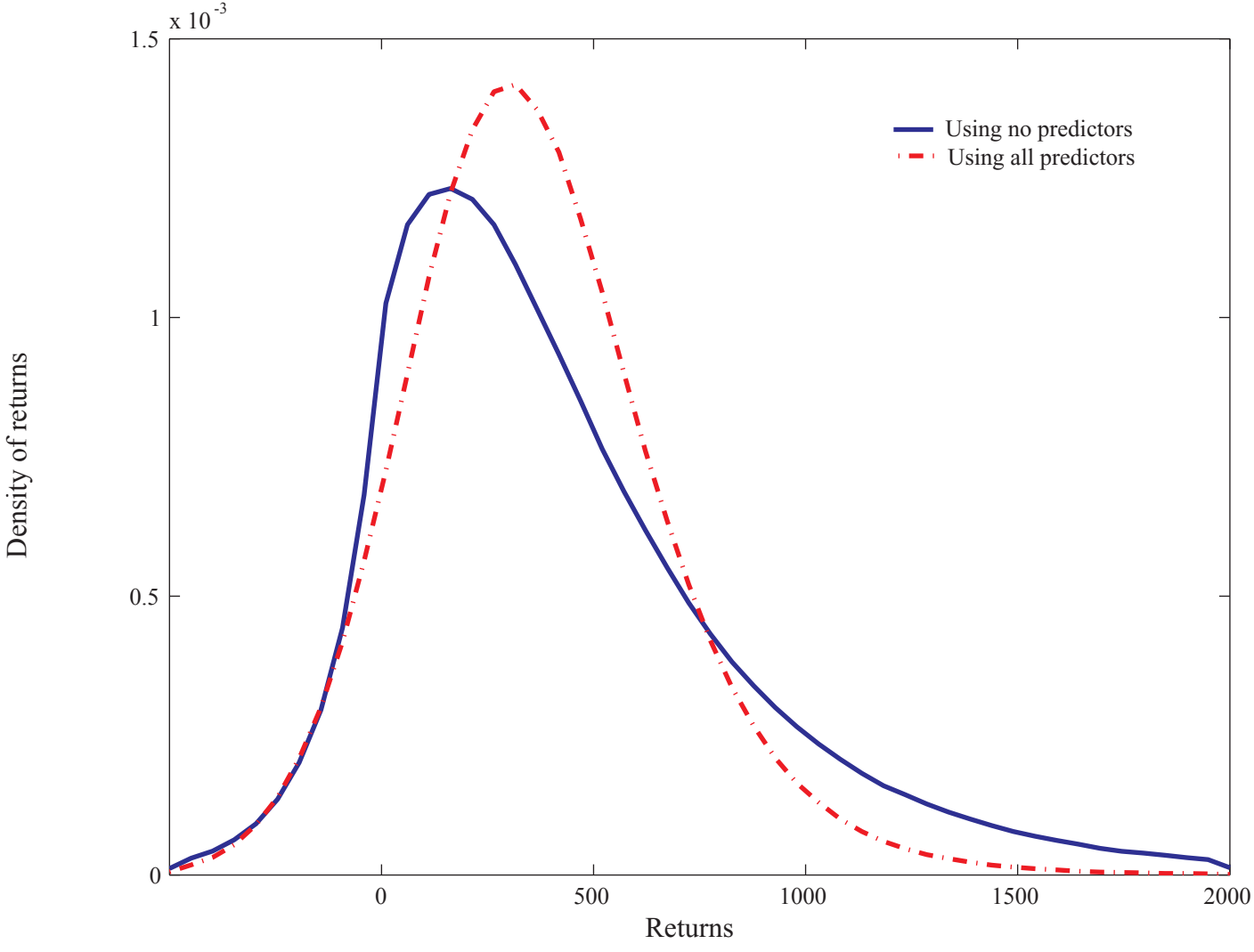


Source: Carneiro, Hansen and Heckman (2003).

Figure 2.15

Returns to college under different information sets

NLSY79



Source: Carneiro, Hansen and Heckman (2003).

Table 2.4
Return to one year of college for individuals
at different percentiles of the math test score distribution
White males from High School and Beyond

	5%	25%	50%	75%	95%
Average return in the population	0.1121	0.1374	0.1606	0.1831	0.2101
	(0.0400)	(0.0328)	(0.0357)	(0.0458)	(0.0622)
Return for those who attend college	0.1640	0.1893	0.2125	0.2350	0.2621
	(0.0503)	(0.0582)	(0.0676)	(0.0801)	(0.0962)
Return for those who do not attend college	0.0702	0.0954	0.1187	0.1411	0.1682
	(0.0536)	(0.0385)	(0.0298)	(0.0305)	(0.0425)
Return for those at the margin	0.1203	0.1456	0.1689	0.1913	0.2184
	(0.0364)	(0.0300)	(0.0345)	(0.0453)	(0.0631)

Wages are measured in 1991 by dividing annual earnings by hours worked per week multiplied by 52. The math test score is and average of two 10th grade math test scores. There are no dropouts in the sample and the schooling variable is binary (high school - college). The gross returns to college are divided by 3.5 (average difference in years of schooling between high school graduates that go to college and high school graduates that do not in a sample of white males in the NLSY). To construct the numbers in the table we proceed in two steps. First we compute the marginal treatment effect using the method of local instrumental variables as in Carneiro, Heckman and Vytlacil (2001). The parameters in the table are different weighted averages of the marginal treatment effect. Therefore, in the second step we compute the appropriate weight for each parameter and use it to construct a weighted average of the marginal treatment effect (see also Carneiro, 2002). Individuals at the margin are indifferent between attending college or not.

Table 2.5

Evaluating school quality policies: discounted net returns to decreasing pupil-teacher ratio by 5 pupils per teacher for people with 12 years of schooling in 1990

	Productivity growth rate	Includes 50% social cost of funds	Annual rate of return to earnings from school quality change 1%	2%	4%
7% discount rate					
	0%	Yes	-9056	-8092	-6163
	0%	No	-5716	-4752	-2823
	1%	Yes	-8878	-7736	-5451
	1%	No	-5538	-4396	-2111
5% discount rate					
	0%	Yes	-9255	-7537	-4103
	0%	No	-5597	-3880	-445
	1%	Yes	-8887	-6802	-2632
	1%	No	-5230	-3145	1025
3% discount rate					
	0%	Yes	-8840	-5591	905
	0%	No	-4810	-1562	4934
	1%	Yes	-8036	-3984	4119
	1%	No	-4007	45	8149

Note: All values, in 1990 dollars, are given as net present values at age 6 of an individual; costs of schooling improvements are incurred between ages 6 and 18 and benefits from increased earnings occur between ages 19 and 65. Data for costs are from NCES 1993. Costs of adding new teachers include salaries and capital, administrative, and maintenance expenditures. Estimates of increases in earnings resulting from a decrease in the pupil-teacher ratio by 5 pupils per teacher come from Card and Krueger (1992), table 3, which produces a range of estimated earnings increases from about 1 to 4 percent, whereas most of the estimates are in the 1 to 2 percent range. To capture the benefits of smaller class sizes, students must attend twelve years of higher quality of schooling. We calculate the costs for one year of improvements and then calculate the present value of the costs over the twelve years of school attendance.

Table 2.6
Effects of Early Intervention Programs

Program/Study	Costs[a]	Program description	Test scores	Schooling	Pre-delinquency crime
Abecedarian Project[b] (Ramey et al (1988))	N/A	Full-time year-round classes for children from infancy through preschool	Higher scores at ages 1-4	34% less in-grade retention by second grade; better reading and math proficiency	
Early Training[b] (Gray, Ramey and Klaus(1982))	N/A	Part-time classes for children in summer; weekly home visits during school year	Higher scores at ages 5-10	16% less in-grade retention; 21% higher high school graduation	
Harlem Study (Palmer (1983))	N/A	Individual teacher-child sessions twice-weekly for young males	Higher scores at ages 3-5	21% less in-grade retention	
Houston PCDC[b] (Johnson (1988))	N/A	Home visits for parents for two yrs; child nursery care four days per week in year 2 (Mexican Americans)	Higher scores at age 3		Rated less aggressive and hostile by mothers (ages 8-11)
Milwaukee Project[b] (Garber (1988))	N/A	Full-time year-round classes for children through first grade; job training for mothers	Higher scores at ages 2-10	27% less in-grade retention	

Table 2.6 (continued)

Program/Study	Costs[a]	Program description	Test scores	Schooling	Pre-Delinquency Crime
Mother-Child Home Program (Levenstein, O'Hara, and Madden (1983))	N/A	Home visits with mothers and children twice weekly	Higher scores at ages 3-4	6% less in-grade retention	N/A
Perry Preschool Program[b] (Schweinhart, Barnes, and Weikart (1993))	$13,400	Weekly home visits with parents; intensive, high-quality preschool services for one to two years	Higher scores in all studied years (ages 5-27)	21% less in-grade retention or special services; 21% higher HS graduation rates	2.3 versus 4.6 lifetime arrests by age 27 7% versus 35% arrested 5 or more times
Rome Head Start (Monroe and McDonald (1981))	$5,400 (2 years)	Part-time classes for children; parent involvement		12% less in-grade retention; 17% higher HS graduation rates	
Syracuse University Family Development (Lally, Mangione, and Honig (1988))	$38,100	Weekly home visits for family; day care year round	Higher scores at ages 3-4		6% versus 22% had probation files; offenses were less severe
Yale experiment	$23,300	Family support; home visits and day care as needed for thirty months	Better language development at thirty months	Better school Attendance and adjustment; fewer special adjustments; school services (age 12 1/2)	Rated less aggressive and pre delinquent by teachers and parents (ages 12 1/2)

Note: All comparisons are for program participants versus non-participants. [a] Costs valued in 1990 dollars.

[b] Studies used a random assignment experimental design to determine program impacts. Data from Donohue and Siegelman (1998), Schweinhart, Barnes, and Weikart (1993), and Seitz (1990) for the impacts reported here. N/A indicates not available.

Source: Heckman, Lochner, Smith, and Taber (1997).

Table 2.7

Perry Preschool: Net present values of costs and benefits through age 27

1. Cost of preschool for child, ages 3-4	12,148
2. Decrease in cost to government of K-12 special education courses for child, ages 5 to 18	6,365
3. Decrease in direct criminal justice system costs[a] of child's criminal activity, ages 15 to 28	7,378
4. Decrease in direct criminal justice system costs[a] of child's projected criminal activity, ages 29 to 44	2,817
5. Income from child's increased employment, ages 19 to 27	8,380
6. Projected income from child's increased employment, ages 28 to 65	7,565
7. Decrease in tangible losses to crime victims, ages 15 to 44	10,690
Total benefits:	43,195
Total benefits excluding projections[b]	32,813
Benefits minus costs	31,047
Benefits minus costs excluding projections[b]	20,665

Sources: Karoly et al (1998) and Barnett (1993).

Notes: All values are net present values in 1996 dollars at age 0 calculated using a 4 percent discount rate.

[a]Direct criminal justice system costs are the administrative costs of incarceration.

[b]Benefits from projected decreased criminal activity (4) and projected income from increased employment (6) are excluded.

Table 2.8

Outcomes of early intervention programs

	Program (years of operation)	Outcome	Followed up to Age	Age when treatment effect last statistically significant	Control group	Change in treated group
Cognitive Measures						
	Early Training Project (1962 - 1965)	IQ	16-20	6	82.8	+12.2
	Perry Preschool Project (1962 - 1967)	IQ	27	7	87.1	+4.0
	Houston PCDC (1970 - 1980)	IQ	8-11	2	90.8	+8.0
	Syracuse FDRP (1969 - 1970)	IQ	15	3	90.6	+19.7
	Carolina Abecedarian (1972 - 1985)	IQ	21	12	88.4	+5.3
	Project CARE (1978 - 1984)	IQ	4.5	3	92.6	+11.6
	IHDP (1985 - 1988)	IQ (HLBW[a] sample)	8	8	92.1	+4.4
Educational Outcomes						
	Early Training Project	Special education	16-20	18	29%	-26%
	Perry Preschool Project	Special education	27	19	28%	-12%
		High school graduation		27	45%	+21%
	Chicago CPC (1967 - present)	Special education	20	18	25%	-10%
		Grade retention		15	38%	-15%
		High school graduation		20	39%	+11%
	Carolina Abecedarian	College enrollment	21	21	14%	+22%
Economic Outcomes						
	Perry Preschool Project	Arrest rate	27	27	69%	-12%
		Employment rate		27	32%	+18%
		Monthly earnings		27	$766	+$453
		Welfare use		27	32%	-17%
	Chicago CPC (preschool vs. no preschool)	Juvenile arrests	20	18	25%	-8%
	Syracuse FDRP	Probation referral	15	15	22%	-16%
	Elmira PEIP (1978 - 1982)	Arrests (High risk sample)	15	15	0.53	-45%

Notes: Cognitive measures include Stanford-Binet and Wechsler Intelligence Scales, California Achievement Tests, and ot her IQ and achievement tests measuring cognitive ability. All results significant at .05 level or higher. Source: Karoly (2001).

For a discussion of the specific treatments offered under each program see Heckman (2000) and Karoly (2001).

Houston PCDC is the Houston Parent-Child Development Center. Syracuse FDRP is the Syracuse Family Development Research Program. Project Care is the Carolina Approach to Responsive Education. IHDP is the Infant Health and Development Project. Chicago CPC is the Child-Parent Center. Elmira PEIP is the Elmira (New York) Prenatal/Early Infancy Project.

[a] HLBW = heavier, low birth weight sample.

Table 2.9

Estimated benefits of mentoring programs (treatment group reductions compared to control group)

Program	Outcome measure	Change	Program costs per participant
Big Brother/Big Sister			$500 - $1500[a]
	Initiating drug use	-45.8%	
	Initiation alcohol use	-27.4%	
	Number of times hit someone	-31.7%	
	Number of times stole something	-19.2%	
	Grade point average	3.0%	
	Skipped class	-36.7%	
	Skipped day of school	-52.2%	
	Trust in parent	2.7%	
	Lying to parent	-36.6%	
	Peer emotional support	2.3%	
Sponsor-A-Scholar			$1485
	Tenth grade GPA (100 point scale)	2.9	
	11th grade GPA (100 point scale)	2.5	
	% Attending College (1 year after HS)	32.8%	
	% Attending College (2 years after HS)	28.1%	
Quantum Opportunity Program			N/A
	Graduated HS or GED	+26%	
	Enrolled in 4 year college	+15%	
	Enrolled in 2 year college	+24%	
	Currently employed full time	+13%	
	Self receiving welfare	-22%	
	Percentage ever arrested	-4%	

Sources: Benefits from Heckman (1999) and Taggart (1995), costs from Johnson (1996) and Herrera et al (2000).

[a] Costs, in 1996 dollars, for school-based programs are as low as $500 per participant and more expensive community-based mentoring programs cost as much as $1,500. HS = high school.

Table 2.10

Effects of selected adolescent social programs on schooling, earnings, and crime

Program/Study	Costs[a]	Program Description	Schooling	Earnings[a]	Crime[a]
STEP (Walker and Viella-Velez, (1992))	N/A	Two summers of employment, academic remediation and life skills for 14 to 15 year olds	Short-run gains in test scores; no effect on school completion rates	N/A	N/A
Quantum Opportunities Program[b] (Taggart, (1995))	$10,600	Counseling; educational, community, and development services; financial incentives for four years beginning in ninth grade)	34% higher high graduation and GED reception rates (two years after program)	N/A	4% versus 16% convicted; .28 versus .56 average. number of arrests (2 years after program)

Source: Heckman, Lochner, Smith and Taber (1997).

Notes: All comparisons are for program participants vs. non-participants. N/A indicated not available.

[a] All dollar figures are in 1990 values

[b] Studies used a random assignment experimental design to determine program impacts.

Table 2.11

Rates of return on investment in private job training

Data set	Return
PSID, all males	23.5
NLS (new young cohort)	16.0
NLS (old young cohort)	26.0

Source: Mincer (1993)
PSID is the Panel Study of Income Dynamics. NLS is the National Longitudinal Survey.

Table 2.12
Average marginal effect on participation in company training

Variables	Average marginal effect					
	White males		Black males		hispanic Males	
	(1)	(2)	(1)	(2)	(1)	(2)
Age-adjusted AFQT	0.0149	-	0.0182	-	0.0066	-
	(0.0024)	-	(0.0033)	-	(0.0037)	-
Family income in 1979	-0.0021	-0.0005	-0.0047	-0.0019	0.0011	0.0015
(in $10,000)	(0.0012)	(0.0011)	(0.0024)	(0.0023)	(0.0024)	(0.0023)
Grade completed	0.0382	-	0.0060	-	0.0036	-
	(0.001)	-	(0.0014)	-	(0.0014)	-
Father's education	-0.0014	0.0007	0.0003	0.0010	0.0002	0.0008
	(0.0006)	(0.0005)	(0.0008)	(0.0008)	(0.0007)	(0.0007)
	White females		Black females		Hispanic females	
	(1)	(2)	(1)	(2)	(1)	(2)
Age-adjusted AFQT	0.0076	-	0.0169	-	0.0159	-
	(0.0025)	-	(0.0038)	-	(0.0045)	-
Family income in 1979	-0.0007	0.0001	-0.0006	0.0014	-0.0065	-0.0043
(in $10,000)	(0.0011)	(0.0011)	(0.0024)	(0.0023)	(0.0031)	(0.0029)
Grade completed	0.0027	-	0.0014	-	0.0013	-
	(0.0010)	-	(0.0016)	-	(0.0016)	-
Father's education	0.0001	0.0009	0.0015	0.0021	-0.00001	0.0007
	(0.0006)	(0.0006)	(0.0008)	(0.0008)	(0.0009)	(0.0008)

Note: The panel data set was constructed using NLSY79 data from 1979-1994. Data on training in 1987 is combined with 1988 in the original data set. Company training consists of formal training conducted by employer, and military training excluding basic training.
Specification (1) includes a constant, age, father's education, mother's education, number of siblings, southern residence at age 14 dummy, urban residence at age 14 dummy, and year dummies.
Specification (2) drops age-adjusted AFQT and grade completed. Average marginal effect is estimated using average derivatives from a probit regression. Standard errors are reported in parentheses.

Table 2.13

Effects of accounting for discounting, expected horizon and welfare costs of taxes: Benefit minus cost estimates for JTPA under alternative assumptions regarding benefit persistence, discounting, and welfare costs of taxation (National JTPA study, thirty-month impact sample)

Benefit duration	Direct costs included?	Six-month interest rate	Welfare cost of taxes	Adult males	Adult females	Male youth	Female youth
Thirty Months	No	0.000	0.00	1,345	1,703	-967	136
Thirty Months	Yes	0.000	0.00	523	532	-2,922	-1,180
Thirty Months	Yes	0.000	0.50	108	-54	-3,900	-1,838
Thirty Months	Yes	0.025	0.00	433	432	-2,859	-1,195
Thirty Months	Yes	0.025	0.50	17	-154	-3,836	-1,853
Seven Years	No	0.000	0.00	5,206	5,515	-3843	865
Seven Years	Yes	0.000	0.00	4,375	4,344	-5,798	-451
Seven Years	Yes	0.000	0.50	3,960	3,758	-6,775	1,109
Seven Years	Yes	0.025	0.00	3,523	3,490	-5,166	-610
Seven Years	Yes	0.025	0.50	3,108	2,905	-6,143	-1,268

Source: Heckman and Smith (1998).

Note: "Benefit duration" indicates how long the estimated benefits from JTPA are assumed to persist. Actual estimates are used for the first thirty months. For the seven-year duration case, the average of the amount of benefits in months 18-24 and 25-30 is used as the amount of benefits in each future period. "Welfare cost of taxes" indicates the additional cost in terms of lost output due to each additional dollar of taxes raised. The value 0.50 lies in the range suggested by Browning (1987).

Estimates are constructed by breaking up the time after random assignment into six-month periods. All costs are assumed to be paid in the first six-month period, whereas benefits are received in each six-month period and discounted by the amount indicated for each row of the table.

Table 2.14
Lessons from the evaluation literature

Program	Appears to help	Appears not to help	General observations on effectiveness
Formal classroom training	Women re-entrants	Prime-age men and older workers with low initial education	Important that courses have strong labor market relevance or signal "high" quality to employers. Should lead to a qualification that is recognized and valued by employers.
			Keep programs relatively small in scale.
On-the-job training	Women re-entrants; single mothers	Prime-age men	Must directly meet labor market needs. Hence, need to establish strong links with local employers, but this increases the risk of displacement.
Job search assistance (job clubs, individual counseling, etc.)	Most unemployed but in particular, women and sole parents		Must be combined with increased monitoring of the job-search behaviour of the unemployed and enforcement of work tests.
Of which: re-employment bonuses	Most adult unemployed		Requires careful monitoring and controls on both recipients and their former employers.
Special youth measures (training, employment subsidies, direct job creation measures)		Disadvantaged youths	Effective programs need to combine an appropriate and integrated mix of education, occupational skills, work-based learning, and supportive services to young people and their families.
			Early and *sustained* interventions are likely to be most effective.
			Need to deal with inappropriate attitudes to work on the part of youths. Adult mentors can help.
Subsidies to employment	Long-term unemployed; women re entrants		Require careful targeting and adequate controls to maximize net employment gains, but there is a trade-off with employer take-up.
Of which: Aid to unemployed starting enterprises	Men (below age 40, relatively better educated)		Works only for a small subset of the population.
Direct job creation		Most adult and youth unemployed	Typically provides few long-run benefits and principle of additionality usually implies low marginal-product jobs.

Source: Martin and Grubb (2001).

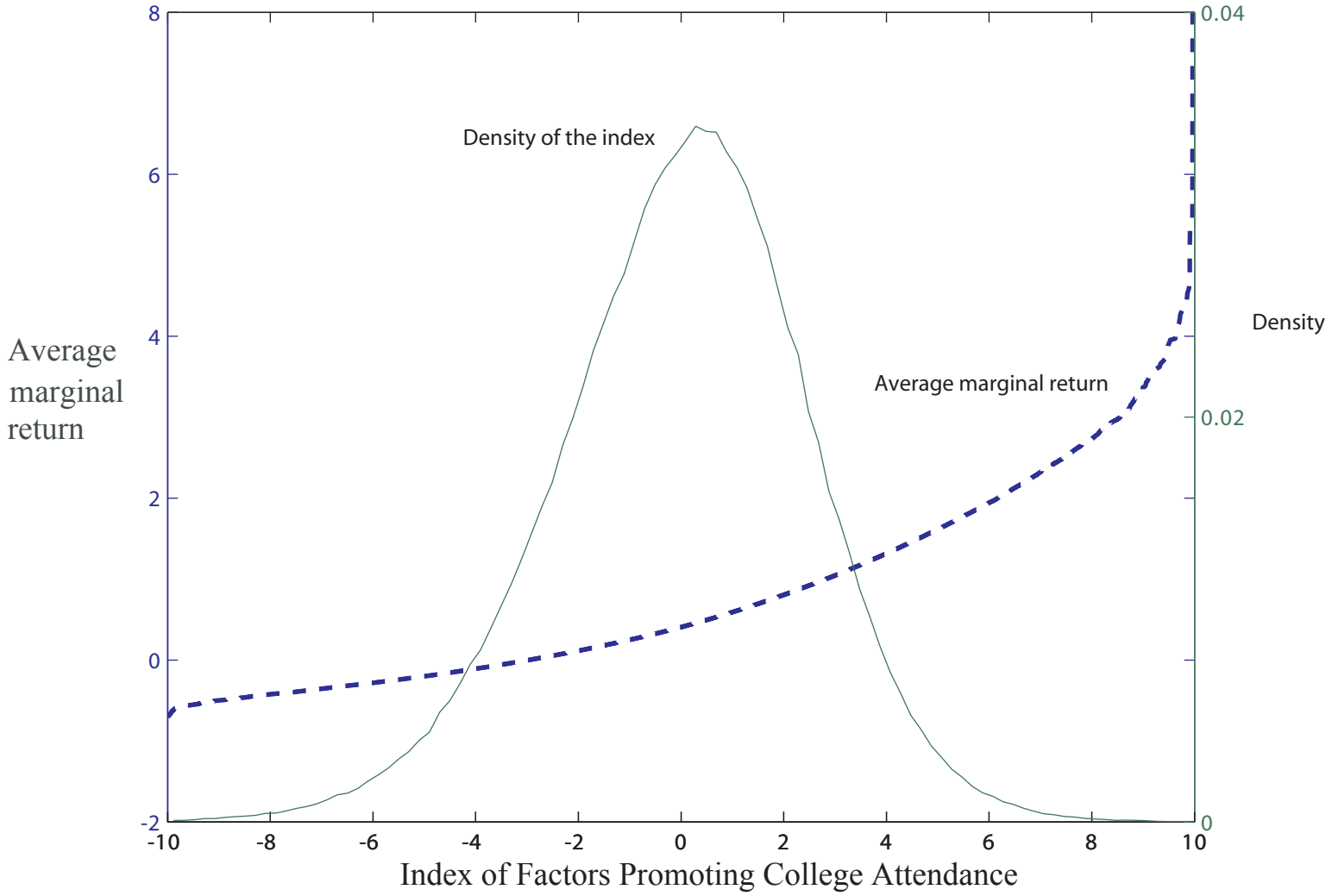
Table 2.15
Benefits and costs of job corps from different perspectives

Benefits or costs	Perspective: Society	Participants	Rest of society
Year 1	-$1,933	-$1,621	-$313
Years 2-4	$2,462	$1,626	$836
After observation period	$26,678	$17,768	$9,009
Output produced during vocational training in job corps.	$225	$0	$225
benefits from increased output	$27,531	$17,773	$9,758
Benefits from increased output Excluding extrapolation beyond observation	$754	$5	$749
Benefits from reduced use of other programs and services	$2,186	-$780	$2,966
Benefits from reduced crime	$1,240	$643	$597
Program costs	-$14,128	$2,361	-$16,489
Benefits minus costs	$16,829	$19,997	-$3,168
(2) Benefits minus costs excluding extrapolation beyond observation	-$9,949	$2,229	-$12,177
Net benefits per dollar of program expenditures[a]	$2.02		
Net benefits per dollar of program expenditures excluding extrapolation beyond observation[a]	$0.40		

Source: Glazerman, Schocket and Burghart (2001).

Note: All figures in 1995 dollars. [a] The ratio's denominator is the operating cost of the program ($16,489). The ratio's numerator is the benefit to society plus the cost of student pay, food, and clothing ($2,361). The cost of student pay, food and clothing is included in the numerator to offset the fact that it is included in the denominator even though it is not a cost to society.

Figure 2.16
Average marginal returns for those at the margin
of indifference between college and high school



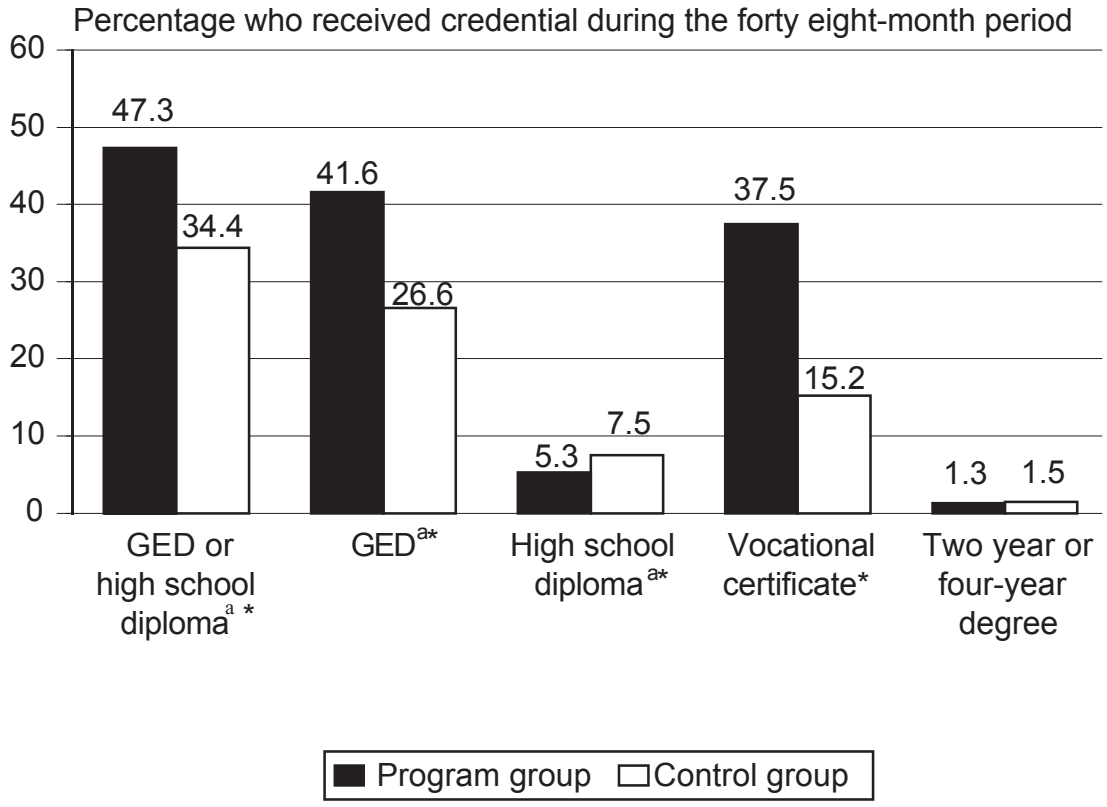
Source: Carneiro, Hansen, and Heckman (2003).

Notes: Average marginal return is computed for persons at the margin of attending college for a given level of index. Factors promoting schooling refer to variables related to schooling (higher level of index leads to a higher probability of attending college).
The density in the figure corresponds to the density of individuals at each level of the index.

Figure 2.17

Job Corps. Evaluation

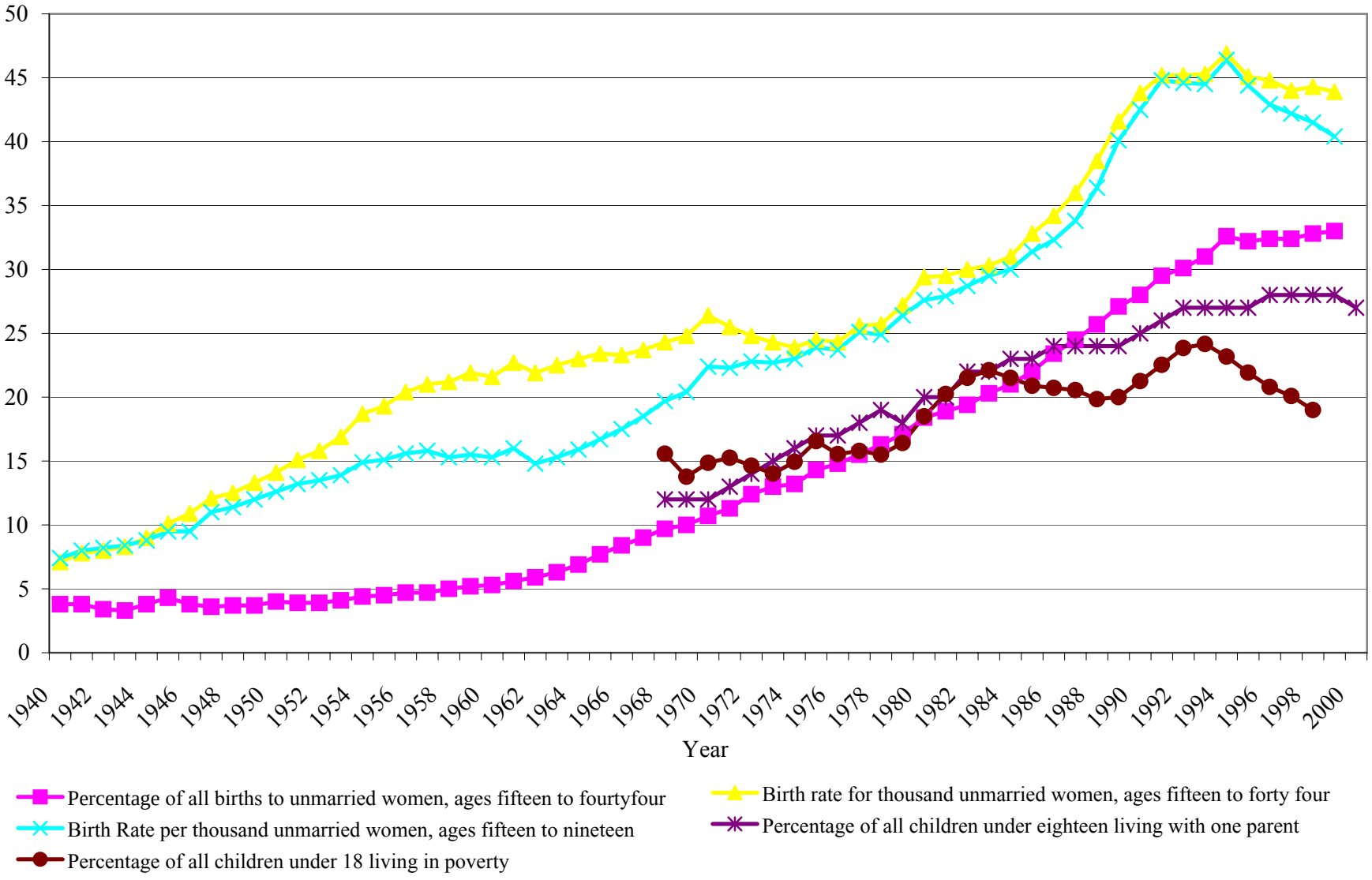
DEGREES, DIPLOMAS, AND CERTIFICATES RECEIVED



Source: Baseline and 12- , 30- , and 48-month follow-up interview data for those who completed 48-month interviews. See Schochet et al.2001

[a]Figures pertain to those who did not have a high school credential at random assignment.
*Difference between the mean outcome for program and control group members is statistically significant at the 5 percent level. This difference is the estimated impact per eligible applicant.

Figure 2.18
Trends in Unhealthy Child Environments

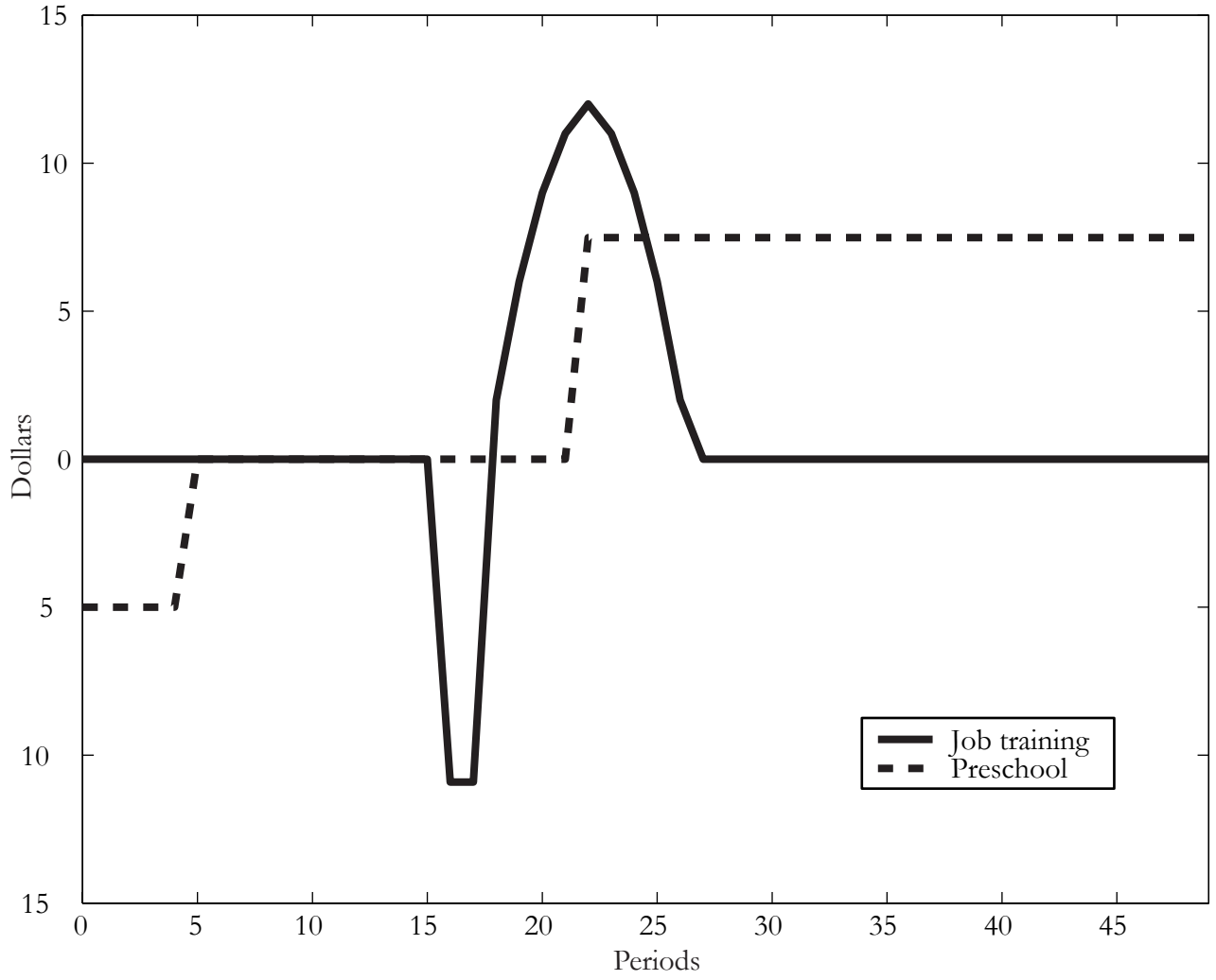


Data for births and birth rates are from Ventura and Bachrach (2000). Data for children living with one parent are available at the census bureau at http://www.census.gov/population/socdemo/hh-fam/tabCH-1.txt. Data for children living in poverty is available at www.childtrendsdatabank.org/

Appendix A

Figure 2.A.1

Prototypical payoff streams



Appendix B

Table 2B.1

NLSY79 white males: Gaps in enrollment, completion, delay, and type of college (measured relative to the highest income quartile) conditioning on parental education, number of siblings, broken home, south, and urban

	AFQT tercile 1			AFQT tercile 2			AFQT tercile 3			Not conditioning on AFQT		
	Beta	Std. err.	t-stat.	Beta	Std. err.	t-stat.	Beta	Std. err.	t-stat	Beta	Std. err.	t-stat
					Panel A - Enrollment in college							
q4-q1	0.1178	0.0718	1.64	0.0807	0.0687	1.18	0.0366	0.0679	0.54	0.1054	0.0374	2.81
q4-q2	0.0808	0.0671	1.20	0.0584	0.0580	1.01	0.0398	0.0568	0.70	0.0782	0.0332	2.36
q4-q3	0.0870	0.0663	1.31	0.0126	0.0511	0.25	0.0966	0.0519	1.86	0.0678	0.0309	2.19
All gaps = 0	F(3, 454) = 0.94			F(3, 499) = 0.65			F(3, 491) = 1.18			F(3, 1606) = 3.09		
					Panel B - Complete 4 year college							
q4-q1	-0.2815	0.1439	-1.96	0.0703	0.1123	0.63	-0.0379	0.0906	-0.42	-0.0076	0.0618	-0.12
q4-q2	-0.2943	0.1416	-2.08	0.0714	0.0885	0.81	0.0316	0.0712	0.44	0.0265	0.0512	0.52
q4-q3	-0.1918	0.1377	-1.39	-0.0658	0.0719	-0.92	0.0681	0.0638	1.07	-0.0215	0.0453	-0.47
All gaps = 0	F(3, 100) = 1.75			F(3, 252) = 1.08			F(3, 272) = 0.65			F(3, 692) = 0.30		
					Panel C - Complete 2 year college							
q4-q1	0.5377	0.3541	1.52	0.0520	0.1713	0.30	0.0584	0.0665	0.88	0.0891	0.0967	0.92
q4-q2	0.2472	0.2339	1.06	0.1164	0.1449	0.80	0.0348	0.0546	0.64	0.0290	0.0802	0.36
q4-q3	0.0983	0.2242	0.44	-0.0716	0.1382	-0.52	-0.0399	0.0533	-0.75	-0.1358	0.0760	-1.79
All gaps = 0	F(3, 41) = 1.01			F(3, 68) = 0.57			F(3, 76) = 0.86			F(3, 219) = 2.66		
					Panel D - Proportion of people not delaying college entry							
q4-q1	0.1637	0.2111	0.78	-0.0375	0.1537	-0.24	-0.1483	0.1316	-1.13	0.0039	0.0874	0.04
q4-q2	0.4207	0.1931	2.18	0.0616	0.1091	0.56	0.0786	0.0917	0.86	0.1668	0.0655	2.55
q4-q3	0.3717	0.1907	1.95	-0.0596	0.0890	-0.67	0.0525	0.0925	0.57	0.0492	0.0599	0.82
All gaps = 0	F(3, 54) = 1.98			F(3, 123) = 0.50			F(3, 135) = 1.17			F(3, 349) = 2.53		
					Panel E - Enrollment in 4 year versus 2 year college							
q4-q1	0.0400	0.1264	0.32	0.0089	0.0806	0.11	0.1103	0.0764	1.44	0.0272	0.0483	0.56
q4-q2	0.2185	0.1119	1.95	0.0448	0.0662	0.68	0.1169	0.0607	1.92	0.0654	0.0400	1.64
q4-q3	0.2700	0.1072	2.52	-0.0361	0.0556	-0.65	0.0197	0.0563	0.35	0.0278	0.0361	0.77
All gaps = 0	F(3, 150) = 3.01			F(3, 329) = 0.53			F(3, 357) = 1.60			F(3, 920) = 0.90		

Source: Carneiro and Heckman (2002).

Note: Within each AFQT tercile we regress college enrollment (completion, delay, type of college) on family background and indicator variables for each income quartile. Quartile 4 is the highest and quartile 1 is the lowest quartile.
q4-q1 —Gap in enrollment, completion, delay and type of college between quartiles 4 and 1
q4-q2 —Gap in enrollment, completion, delay and type of college between quartiles 4 and 2
q4-q3 —Gap in enrollment, completion, delay and type of college between quartiles 4 and 3
All gaps are measured relative to the highest income group within each ability class. Each of the first three sets of columns in this table represents a different AFQT tercile. The last set of three columns groups all test score terciles together. Each row in each group of three rows corresponds to a different comparison between two income quartiles. The baseline quartile is the richest.
In the columns under the heading "Not conditioning on AFQT," we compute gaps in college enrollment (completion, delay, type of college) for the whole population, without dividing it into different AFQT tertiles. For example, the gap in college enrollment between the lowest and the highest income quartile within the highest AFQT tercile is 0.0366.

Table 2B.2

Family background gaps for white males, NLSY79

(measured relative to the highest family background/AFQT quartile)

	Enrollment in college			Two year college completion		
Gap:	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat
q4-q1	0.580	0.042	13.810	-0.374	0.154	-2.429
q4-q2	0.370	0.034	10.882	-0.189	0.077	-2.455
q4-q3	0.299	0.029	10.310	-0.124	-0.067	-1.851

	4 year college completion			Percentage with no delay of entry		
	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat
q4-q1	0.615	0.108	5.694	0.499	0.159	3.138
q4-q2	0.337	0.060	5.617	0.188	0.075	2.507
q4-q3	0.137	0.043	3.186	0.099	0.056	1.768

	Years of delay			Enrollment in Four year versus Two year college		
	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat
q4-q1	-2.793	0.817	-3.419	0.040	0.084	0.476
q4-q2	-1.301	0.387	-3.362	0.133	0.045	2.956
q4-q3	-0.627	0.286	-2.192	0.054	0.034	1.588

q4-q1 —Gap in enrollment, completion, delay and type of college between quartiles 4 and 1
q4-q2 —Gap in enrollment, completion, delay and type of college between quartiles 4 and 2
q4-q3 —Gap in enrollment, completion, delay and type of college between quartiles 4 and 3

Table 2B.3
Gaps in enrollment, completion, delay, and type of college
White males, NLSY79
(Measured relative to the highest family background / AFQT quartile)

Panel A - enrollment in college

	Lowest AFQT tertile			Middle AFQT tertile			Highest AFQT tertile		
Variable:	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat
q4-q1	0.118	0.072	1.640	0.081	0.069	1.180	0.037	0.068	0.540
q4-q2	0.081	0.067	1.200	0.058	0.058	1.010	0.040	0.057	0.700
q4-q3	0.087	0.066	1.310	0.013	0.051	0.250	0.097	0.052	1.860
Southern residence at age 14	0.012	0.047	0.260	0.006	0.047	0.130	-0.070	0.049	-1.430
Broken home	0.076	0.051	1.500	-0.002	0.060	-0.040	0.069	0.057	1.200
Urban residence at age 14	-0.054	0.048	-1.120	-0.042	0.048	-0.870	0.013	0.047	0.280
Mother's education	-0.024	0.011	-2.310	-0.035	0.011	-3.150	-0.023	0.011	-2.100
Father's education	-0.029	0.008	-3.640	-0.042	0.008	-5.390	-0.042	0.008	-5.160
Constant	0.213	0.138	1.550	0.347	0.136	2.550	0.133	0.137	0.970

Panel B - two year college completion rate

	Lowest AFQT tertile			Middle AFQT tertile			Highest AFQT tertile		
Variable:	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat
q4-q1	0.538	0.354	1.520	0.052	0.171	0.300	0.058	0.066	0.880
q4-q2	0.247	0.234	1.060	0.116	0.145	0.800	0.035	0.055	0.640
q4-q3	0.098	0.224	0.440	-0.072	0.138	-0.520	-0.040	0.053	-0.750
Southern residence at age 14	-0.010	0.204	-0.050	0.156	0.119	1.310	-0.046	0.050	-0.900
Broken home	0.188	0.268	0.700	0.057	0.154	0.370	-0.240	0.056	-4.320
Urban residence at age 14	0.084	0.182	0.460	0.247	0.139	1.770	0.036	0.045	0.790
Mother's education	0.067	0.053	1.270	-0.020	0.028	-0.720	0.012	0.012	0.990
Father's education	-0.007	0.038	-0.190	-0.012	0.021	-0.570	-0.010	0.010	-1.090
Constant	-1.510	0.618	-2.450	-0.133	0.340	-0.390	-0.040	0.136	-0.290

Panel C - four year college completion rate

	Lowest AFQT tertile			Middle AFQT tertile			Highest AFQT tertile		
Variable:	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat
q4-q1	-0.281	0.144	-1.960	0.070	0.112	0.630	-0.038	0.091	-0.420
q4-q2	-0.294	0.142	-2.080	0.071	0.088	0.810	0.032	0.071	0.440
q4-q3	-0.192	0.138	-1.390	-0.066	0.072	-0.920	0.068	0.064	1.070
Southern residence at age 14	0.040	0.107	0.370	-0.008	0.074	-0.110	-0.015	0.060	-0.240
Broken home	0.186	0.120	1.550	-0.091	0.100	-0.910	-0.008	0.077	-0.110
Urban residence at age 14	-0.004	0.128	-0.030	-0.121	0.075	-1.610	-0.007	0.061	-0.120
Mother's education	-0.029	0.023	-1.230	-0.027	0.017	-1.610	-0.017	0.013	-1.320
Father's education	-0.035	0.018	-1.960	-0.026	0.012	-2.260	-0.015	0.009	-1.640
Constant	0.584	0.378	1.550	0.223	0.214	1.050	-0.338	0.169	-2.000

q4-q1 —Gap in enrollment, completion, delay and type of college between quartiles 4 and 1
q4-q2 —Gap in enrollment, completion, delay and type of college between quartiles 4 and 2
q4-q3 —Gap in enrollment, completion, delay and type of college between quartiles 4 and 3

Table 2B.3 (continued)
Gaps in enrollment, completion, delay, and type of college
White males, NLSY79
(Measured relative to the highest family background / AFQT quartile)

Panel D - percentage with no delay of entry

	Lowest AFQT tertile			Middle AFQT tertile			Highest AFQT tertile		
Variable:	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat
q4-q1	0.164	0.211	0.780	-0.038	0.154	-0.240	-0.148	0.132	-1.130
q4-q2	0.421	0.193	2.180	0.062	0.109	0.560	0.079	0.092	0.860
q4-q3	0.372	0.191	1.950	-0.060	0.089	-0.670	0.053	0.093	0.570
Southern residence at age 14	-0.209	0.145	-1.440	-0.023	0.092	-0.250	0.090	0.086	1.040
Broken home	-0.023	0.185	-0.120	-0.117	0.119	-0.980	0.242	0.095	2.540
Urban residence at age 14	0.180	0.152	1.190	-0.142	0.096	-1.480	-0.009	0.080	-0.110
Mother's education	-0.056	0.030	-1.860	-0.022	0.024	-0.930	-0.025	0.020	-1.280
Father's education	0.028	0.027	1.030	-0.013	0.015	-0.870	-0.010	0.014	-0.680
Constant	-0.511	0.488	-1.050	-0.151	0.289	-0.520	-0.371	0.258	-1.440

Panel E - years of delay of entry

	Lowest AFQT tertile			Middle AFQT tertile			Highest AFQT tertile		
Variable:	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat
q4-q1	0.629	1.418	0.440	-0.851	0.781	-1.090	-0.106	0.555	-0.190
q4-q2	-1.652	1.298	-1.270	-1.258	0.554	-2.270	-0.747	0.386	-1.930
q4-q3	-0.781	1.281	-0.610	-0.299	0.452	-0.660	-0.302	0.390	-0.770
Southern residence at age 14	1.559	0.976	1.600	0.403	0.467	0.860	-0.332	0.364	-0.910
Broken home	-1.158	1.245	-0.930	0.370	0.605	0.610	-0.146	0.401	-0.360
Urban residence at age 14	1.050	1.019	1.030	0.054	0.489	0.110	0.057	0.335	0.170
Mother's education	0.363	0.203	1.790	0.061	0.122	0.490	0.157	0.084	1.870
Father's education	-0.149	0.182	-0.820	0.035	0.078	0.450	0.022	0.060	0.370
Constant	-5.242	3.277	-1.600	-1.847	1.467	-1.260	-2.776	1.088	-2.550

Panel F - type of school

	Lowest AFQT tertile			Middle AFQT tertile			Highest AFQT tertile		
Variable:	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat	Coefficient	Std. err.	*t*-stat
q4-q1	0.040	0.126	0.320	0.009	0.081	0.110	0.110	0.076	1.440
q4-q2	0.219	0.112	1.950	0.045	0.066	0.680	0.117	0.061	1.920
q4-q3	0.270	0.107	2.520	-0.036	0.056	-0.650	0.020	0.056	0.350
Southern residence at age 14	-0.044	0.089	-0.490	0.057	0.055	1.030	-0.014	0.052	-0.260
Broken home	-0.103	0.104	-0.990	0.012	0.073	0.170	0.019	0.065	0.290
Urban residence at age 14	-0.128	0.096	-1.330	0.055	0.057	0.960	0.045	0.052	0.850
Mother's education	0.014	0.020	0.700	-0.027	0.012	-2.210	-0.025	0.011	-2.170
Father's education	0.007	0.015	0.480	-0.013	0.009	-1.550	-0.013	0.009	-1.540
Constant	-0.963	0.301	-3.200	-0.298	0.157	-1.900	-0.340	0.147	-2.320

q4-q1 —Gap in enrollment, completion, delay and type of college between quartiles 4 and 1
q4-q2 —Gap in enrollment, completion, delay and type of college between quartiles 4 and 2
q4-q3 —Gap in enrollment, completion, delay and type of college between quartiles 4 and 3

Table 2B.4

Coefficients for the construction of the family background index

Regression of college enrollment on southern and urban origin, broken home, and parental education, white males, NLSY79		
Variable:	Coefficient	Std. err.
Southern origin	-0.0266	0.0233
Broken home	-0.0544	0.0270
Urban origin	0.0603	0.0235
Mother's education	0.0310	0.0054
Father's education	0.0400	0.0033
AFQT	0.0046	0.0006
Constant	-0.6814	0.0538