

NBER WORKING PAPER SERIES

POLICIES TO FOSTER HUMAN CAPITAL

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Working Paper 7288

<http://www.nber.org/papers/w7288>

NATIONAL BUREAU OF ECONOMIC RESEARCH

1050 Massachusetts Avenue

Cambridge, MA 02138

August 1999

The research reported here was supported by the National Science Foundation, the Russell Sage Foundation, and the American Bar Foundation. I have benefited from comments by Lance Lochner, Larry Katz, Jeanne Grossman, Jeanne Brooks-Gunn, Steve Pischke, Jeffrey Smith, Sharon and Craig Ramey, and Lindsay Chase-Lansdale. A previous version of this paper was presented at the Gideon Fishelson Memorial lecture at the University of Tel Aviv, December 1998. The views expressed herein are those of the authors and not necessarily those of the National Bureau of Economic Research.

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NBER Working Paper No. 7288

August 1999

JEL No. D33

### **ABSTRACT**

This paper considers the sources of skill formation in a modern economy and emphasizes the importance of both cognitive and noncognitive skills in producing economic and social success and the importance of both formal academic institutions and families and firms as sources of learning. Skill formation is a dynamic process with strong synergistic components. Skill begets skill. Early investment promotes later investment. Noncognitive skills and motivation are important determinants of success and these can be improved more successfully and at later ages than basic cognitive skills. Methods currently used to evaluate educational interventions ignore these noncognitive skills and therefore substantially understate the benefits of early intervention programs and mentoring and teenage motivation programs. At current levels of investment, American society underinvests in the very young and overinvests in mature adults with low skills.

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In response to the new labor market for skills in which the real wages paid to high-skilled and highly educated workers have increased while the real wages paid to low skilled and less educated workers have decreased, there is renewed interest in policies designed to foster the formation of socially productive skills in economies around the globe. Politicians and social commentators routinely express concern about the political and social consequences of growing economic inequality. A consensus is emerging that increasing the skills of the unskilled will bring them into the modern economy and will alleviate inequality and that increasing the supply of skilled workers will help to dampen the rising wage or employment gap between the skilled and the unskilled by making skilled workers less scarce and lifting the less skilled into skilled status.

Politicians of all parties in the U.S. agree that reforms in finance and in educational administration are required. Their counterparts in other countries are equally enthusiastic about policies to raise skill levels.

In this paper, I want to examine the foundations of current policies toward skill formation. I re-examine the conventional wisdom on these matters as articulated by our political leaders drawing on a body of recent scholarship that challenges many of the premises that govern popular policy discussions in many countries. This scholarship suggests that a broader view of the way skills are produced in a modern economy is more appropriate. Once this body of research becomes accepted into the mainstream, the public discourse on skill formation will be substantially altered.

Current policies regarding education and job training are based on fundamental misconceptions about the way socially useful skills embodied in persons are produced. They focus on cognitive skills as measured by achievement or IQ tests to the exclusion of social skills, self discipline and a variety of non-cognitive skills that are known to determine success in life. The preoccupation with cognition and academic "smarts" as measured by test scores to the exclusion of social adaptability and motivation causes a serious bias in the evaluation of many human capital interventions.

The conventional wisdom espoused by most politicians, educated laypersons and even many academics places formal educational institutions in a central role as the main producers of the skills required by the modern economy. It neglects the crucial role of families and firms in fostering skill and the variety of abilities required to succeed in the modern economy. Popular discussions of skill formation almost always focus on expenditures in schools or on educational reforms and neglect important noninstitutional sources of skill formation, which are equally important, if not more important, producers of the varieties of skills that are useful in a modern economy.

The current emphasis in policy discussions on formal schooling to the exclusion of informal, noninstitutional, sources of learning is a consequence of three blind spots in the vision of politicians and policy analysts. The first blindspot is factual in nature and arises from a failure to recognize that learning is a lifetime affair and that much learning takes place outside of schools. Learning starts in infancy long before formal education begins and continues throughout life. Recent research in psychology and cognition demonstrates the vital importance for skill formation of the early preschool years when human ability and motivation are shaped by families and noninstitutional environments. Success or failure at this stage feeds into success or failure in school which in turn leads to success or failure in post-school learning. Early learning begets later learning and early success breeds later success just as early failure breeds later failure. Formal or institutional education is only one aspect of the learning process, albeit an important one, and recent research indicates that it is not necessarily the most important one.

In addition, since the publication of the Coleman Report (1966), we have known that families and environments - not just - or even - schools - play the crucial role in motivating and producing educational success as measured by test scores. Failed families produce low ability, poorly motivated students who do not succeed in school. Policies directed toward families may be a more effective means for improving the performance of schools than direct expenditure on teacher salaries or computer equipment. Policies that seek to

remedy deficits incurred in early years are much more costly than early investments wisely made, and do not restore lost capacities even when large costs are incurred. The later in life we attempt to repair early deficits, the costlier the remediation becomes. (See the evidence in Ramey and Ramey, 1998).

On the other side of the educational process, the work experience and skills acquired in the workplace in the form of job search, learning by doing and workplace education are often neglected in popular discussions because they are not well measured. Post-school learning is an important source of skill formation that accounts for as much as one third to one half of all skill formation in a modern economy. (See the discussion in Heckman, Lochner and Taber, 1998.) Because much of this learning takes place in informal settings outside of educational institutions, it gets neglected by the educational technocrats and the politicians who equate skill formation with classroom learning. Once we recognize the importance of informal sources of learning for skill formation, we think about policies to foster skill in a different way.

A second blind spot in the vision of most educational planners and policy makers is a preoccupation with achievement tests and measures of cognitive skill as indicators of success of an educational intervention. It is certainly true that cognitive ability is important in life, and there is some evidence that the return to cognitive ability has increased over time. (See however, Cawley, Heckman and Vytlačil for a discussion of the fragility of this evidence). However, this narrow focus on cognition ignores the full array of socially and economically valuable non- cognitive skills and motivation produced by schools, families and other institutions. This emphasis critically affects the way certain early intervention programs have been evaluated, as I demonstrate in this paper. Enriched early intervention programs do not substantially alter IQ. However, they substantially raise the noncognitive skills and social attachment of participants.

Another common error in the analysis of human capital policies is the assumption that abilities are fixed at very early ages. This static conception of ability is at odds with a

large body of research in the child development literature. In the early years of life, basic abilities can be altered. Schooling produces ability; ability creates a demand for schooling. The early human capital literature as summarized in Becker (1964) suggests a false contrast between human capital and innate ability as rival determinants of earnings.

A more correct view of ability (or rather abilities) is that they are created in a variety of learning situations and that ability in turn fosters further learning. More able people acquire more skills; more skilled people become more able. Dynamic complementarity characterizes skill and ability formation and our economic models have to be modified to account for this.

A third blind spot in the vision of most educational planners and policy makers is a fundamental mistrust of the wisdom of parents to choose wisely if offered choices about their children's education. There is mistrust of competition and incentives as means of improving the performance of schools.

There is also substantial mistrust of "unregulated" informal learning whether it is in the workplace or the home. Although the failure of social planning in Eastern Europe and elsewhere is widely acknowledged, the social planning mentality is alive and well in the local monopoly that is American public education at the primary and secondary levels and that characterizes the provision of public education around the world. Everything we know suggests that most parents care dearly about the education of their children and eventually recognize a good school from a bad one. When offered choices and the opportunity to experiment, most parents generally choose wisely, at least after they have gained some experience. They can distinguish the good teachers from bad ones, and the good schools from the bad schools.

Everything we know also points to the benefits of competition. Monopolists in all areas of economic and social life indulge their own tastes, and ignore the well-being of their customers in a way that competitors cannot.

In this paper, I examine the merits of some of the recent policy proposals by examining

the evidence - or lack of evidence - supporting them. For example, much educational policy regarding college attendance is premised on the myth that many bright but poor students are being denied a college education by the inadequate financial resources of their families. This belief is the cornerstone of commonly advocated educational policies, such as the recently enacted Hope Scholarship program.

The entire field of educational research is littered with myths like this that guide public policy. We are told that reducing class size or increasing per pupil expenditure in primary and secondary schools will produce substantial improvements in educational outcomes. Yet most of the evidence points to the contrary. We are told that education produces substantial externalities - benefits harvested by others beyond those captured by the people who are educated. These externalities are said to justify subsidies to education. Yet a careful reading of the evidence finds little evidence of such externalities in Western economies. (Heckman and Klenow, 1998).

In analyzing the evidence for these and other claims and their relevance for educational policy, it is important to distinguish statements about a world in which there is no educational policy from the world in which we live. The relevant question is whether we should increase current subsidies – not whether there should be any subsidies at all. At a very low level of expenditure, increasing schooling quality definitely improves 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%. The relevant policy question is whether that subsidy should be increased and not whether there should be any subsidy at all.

Myths abound about job training policy as well. Many economies around the world have large groups of unskilled workers made obsolete by a rapid shift in demand toward more skilled workers. A dangerous myth that motivates welfare reform and training policy in many countries is that it is relatively easy to adapt adult unskilled workers to the modern economy. Under this view, most of the low skilled people can easily be trained to be skilled

labor. In this paper, I will demonstrate how high these costs actually are. In an era of tight budgets, it is far from obvious that investments in low skill workers made obsolete by changes in technology are justified on any but political grounds. The major cost of such investment is the diversion of resources away from the young and the more trainable for whom a human capital investment strategy is likely to be more effective and for whom it is likely to produce favorable outcomes in the long run.

Also missing from current policy discussions of education and training policy is any consideration of priorities or recognition of the need to prioritize. In an era of tight government budgets, it is impractical to consider active investment programs for all persons. The real question is how to use the available funds wisely. The best evidence supports the policy prescription: Invest in the very young and improve basic learning and socialization skills; subsidize the old and the severely disadvantaged to attach them to the economy and the society at large.

Figure 1 summarizes the main theme of this lecture. It conveys two very different ideas. The first is a theoretical proposition. For the same level of investment at each age, the return is higher in human capital when a dollar is spent on the young than when it is spent on the old. This is so because the old have a shorter time to recoup their investment due to the shorter time remaining to them. (Becker, 1964). An even more important point not made by Becker is that human capital has fundamental dynamic complementarity features. Learning begets learning. Skills acquired early on make later learning easier. More able people find earning easier.<sup>1</sup>

The second interpretation of Figure 1 is as an empirical description of the current level of spending on human resources in the American economy. At current levels of investment, the returns to investment in the young are quite high; the returns to investment in the old and less able are quite low. A socially optimal investment strategy would equate

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<sup>1</sup>Heckman, Lochner and Taber (1998) develop a sequential model of human capital investment at later stages.



returns across all investment levels. The central conclusion of this paper is that at current total investment levels, efficiency would be enhanced if human capital investment were reallocated to the young.

### **I. The New American Labor Market: A Quantitative Assessment.**

Since the early 80s, the real wages of unskilled American males have declined. Skill differentials have widened around the world. The real wages of skilled workers have increased. Accompanying the decline in the wages of the unskilled is a decline in labor market activity, especially among the unskilled. A variety of labor force measures show increasing joblessness and longer unemployment spells for persons with low skills. This phenomenon is especially prominent in European countries with inflexible wages for low-skill workers.

#### **Measuring The Loss in the Value of Human Capital Among the Less Skilled**

In order to gauge the magnitude of the capital losses imposed on the unskilled by the new labor market I offer the following back-of-the-envelope calculation of the human capital losses experienced by unskilled workers in the new American labor market.<sup>2</sup> For human capital, a round, and roughly correct, average rate of return across all ability groups is 10%. Thus, for each \$10 invested in a person, the expected annual return is \$1. Later on in this paper, I will argue that based on the evidence, 10% is far too high a rate of return for low skilled and older workers so the calculations I am about to give are biased downward in estimating the costs of investment to raise quantities of human capital to offset price declines and restore real earnings. At a 10% return, to add \$1,000 in earnings per year to the average person it is necessary to make a one time investment of \$10,000 in that person. Using a 10% rate, the investment needed to reduce any wage gap is ten times the amount of the gap.

To put the magnitude of recent developments in the labor market in perspective, consider the answers to the following two questions:

#### **(A). How much would we have to invest in our workforce in 1989 dollars to**

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<sup>2</sup>This calculation was first made in Heckman (1994).

**restore real earnings of male high school dropouts and graduates to their real 1979 levels?**

This question is meaningful only for men because real weekly earnings for women have risen or remained roughly constant over the period 1979-1989. A second question is:

**(B). How much would we have to invest in our workforce in 1989 dollars to restore 1979 earnings ratios between lower education groups and college graduates, without reducing the 1989 earnings of college graduates?**

Using a 10% rate of return, it would require an investment of \$25,000 in each high school dropout or a staggering \$214 billion in 1989 dollars to restore male high school dropouts participating in the workforce to their 1979 real earnings level. To restore all high school graduates to their real 1979 levels would take an investment of \$10,000 per high school graduate, or more than \$212 billion 1989 dollars, for a total of \$426 billion in 1989 dollars.

The answer to question **B** is even larger. Table 1 shows the amount needed to restore the 1979 earnings ratio between high school graduates or high school dropouts and college-educated full-time workers over age 25. To restore real earnings for both male and female workers over age 25 that are high school educated or less to their 1979 relative positions with respect to college graduates (holding the latter at 1989 real wage levels) would require an investment of more than 1.66 trillion dollars. These cost estimates are optimistic because they do not consider persons below age 25 or persons who do not participate in the workforce at the current wage levels. They are also optimistic for another reason: few - if any - government training programs have returns anywhere near 10%, although many educational programs realize such returns. Zero percent is a much closer approximation to the true return. One might wish to qualify these calculations in many ways. One might want to adjust down the rate of return as more difficult-to-train persons receive training.

A more sophisticated calculation accounts for the fact that as persons have their skills upgraded, the real wages of the less skilled workers are likely to increase as they become more scarce and the real wages of those with higher skills are likely to decrease as their sup-

ply increases. This calculation gives us another gauge of the magnitude of the investment required to offset the changes in the price of skills in the modern American labor market.

The 1979-1989 percentage change in relative wages of college graduates relative to high school graduates in the U.S. is roughly 14 percentage points. To reverse the ten-year trend by increasing the supply of skilled workers requires a once and for all increase of approximately 20% in the number of high-skilled persons in the workforce. College equivalents are 40% of the workforce and high school equivalents are 60%. For a 1990 workforce of 120 million, about 5.4 million people would have to be transformed to college equivalents to reverse the decade-long erosion of real wages. To maintain this gain in relative wages against the secular trend operating against unskilled labor, about one million additional skilled persons need to be added to the workforce each year on top of the once and for all change of 5.4 million.

As a benchmark, the annual supply of high-skill equivalents to the U.S. economy in the early 1990s is approximately 1.8 million persons. Maintenance of existing skill gaps alone would require that the percentage of persons acquiring post-secondary skills would have to rise by 55%. To phase in the additional 5.4 million people that are required to restore wage parities to their 1979 levels over a ten year period would require a total annual expansion of the supply of high-skill persons of 70-80%. In order to engineer such an increase through a tuition policy, it is necessary to reduce tuition substantially. College tuition would have to be zero and people would have to be paid to attend school.<sup>3</sup> Comparable calculations for other economies reveal the same large scale of the problem.

Given the magnitude of the required investment to restore real earnings levels, and the stringency of current government budgets, it is necessary to use funds wisely. Factually based policy is far more likely to be efficient policy. I now examine the evidence on skill formation and claims made about market failures and family failures that impede skill formation.

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<sup>3</sup>These calculations were first presented in Heckman, Lochner and Taber (1998).

## **II. The Evidence on Credit Constraints and Participation in Schooling and Training Programs**

One of the most widely accepted arguments in policy and academic circles is that credit constraints prevent poor persons from participating in formal education. The empirical association between family income and college enrollment presented in Figure 2 has attracted an enormous amount of attention in academic and policy circles. The most common interpretation of this evidence is that short-term family credit constraints prevent children from low income families from attending school. The Pell Grant program and the recently enacted HOPE fellowship program in the U.S. and many other governmental educational programs are premised on this interpretation. It is the most popular explanation for the time series of the ethnic and racial gaps in college enrollment displayed in Figure 3. Since minority families are concentrated in the lower end of the family income distribution, their failure to respond to the increase in the economic return to schooling is widely viewed as a manifestation of the more general phenomenon of a market failure due to borrowing constraints that prevent poor people from taking advantage of the increase in the return to skills.

The common interpretation of Figure 2 and the one that guides many recent policy proposals for higher education, notes that real tuition costs have increased in percentage terms over the past 16 years. At the same time, family incomes have declined among the bottom quartiles of the family income distribution. The real wages and employment of unskilled males have declined since the late 70s. More families at the bottom of the family income distribution are headed by females with dependent children. Such families have lower earnings and income levels than families headed by males.

According to this interpretation, rising tuition costs and declining family resources have had a devastating impact on the college attendance decisions of children from low income families. Based on this interpretation, policies that further subsidize the already substantial subsidies available to educate children from low income families have been advocated.

It is certainly true that real tuition costs have risen over the past 16 years both in U.S. and in other countries. Between 1980 and 1997, average public posted "sticker price" tuition levels rose by 100% at public four-year colleges and universities and by 77% at public two-year colleges (NCES, 1997). At the same time, it is important to recognize that government subsidies to higher education are already large. All told, individuals attending public institutions of higher education pay on average less than 20% of the total direct cost of attending college. (Direct cost does not include foregone earnings). Moreover, a substantial fraction of the 20% of the total costs borne by individuals is actually paid by private foundations and charities that extend aid directly to students.<sup>4</sup>

The conventional wisdom is that borrowing constraints are binding for prospective college students from low income families and have become more stringent as the poor families have become poorer at precisely the same time that tuition costs have risen along with the rise in the return to education. The conventional argument is that government policy has contributed to the rising inequity in schooling among different family income groups through expanding tuition costs, so it should also help to eliminate it. I now present reasons to doubt the received wisdom.

### **Explanations for the Positive Relationship Between Family Income and College Enrollment**

The argument that family credit constraints are the most plausible explanation for the relationship depicted in Figure 2 starts by correctly 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 lenders in order 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

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<sup>4</sup>Cameron and Heckman (1999) and Heckman and Klenow (1997) discuss the extent of subsidy in greater detail.

their work effort. The lack of collateral and the inability to monitor effort 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, there is no doubt that in the long run the level of educational attainment in society would decline. To the extent that subsidies do not cover the full costs of tuition, persons are forced to raise tuition through private loans, through work while in college or through foregone consumption. Children from families with higher income have access to resources that children from families with lower income do not have, although children from higher income families still depend on the good will of their parents to gain access to funds. 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.

Current tax law in the U.S. exacerbates these problems. Until recently, borrowing costs for education could not be written off against taxes. Even if they could be itemized, few poor families would find it profitable to itemize deductions. Until recently, the only exception to the nondeductibility of interest in the current tax law was mortgage interest. Under the new law enacted in 1997, deductions for student loans are available. These deductions benefit children from families that itemize and are unlikely to have much effect on college attendance for poor children. All families can itemize mortgage interest payments in declaring their taxes. However, poorer families are much less likely to own homes and hence fewer of them are eligible to use mortgages on homes to finance the schooling of their children.

The purchase of education is governed by the same principles that govern the purchase of other goods. There is, undoubtedly, a consumption component to education. (See Lazear, 1977). Families with higher incomes buy more of the good for their children and buy higher quality education as well. This factor partly explains the relationships presented in Figure 2.

An alternative and not necessarily mutually exclusive interpretation of the same evi-

dence 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 income 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. The influences of family factors that are present from birth through adolescence accumulate over many years to produce ability and college readiness.

This alternative interpretation stresses the role of family and the environment and does not necessarily rule out the importance of short-term borrowing constraints as a partial explanation for Figures 2 and 3. 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 is unlikely to be effective. Policy that improves the environments that shape ability may be a more effective avenue for increasing college enrollment in the long run. The issue can be settled empirically. Surprisingly little data have been brought to bear on it until recently.

The distinction between long-run family factors that promote college readiness and short-term borrowing constraints can be conceptualized by imagining an experiment in which a random sample of families is drawn and some of the families win a million dollar lottery at different points in the life cycle of their children. Those who win as their children near high school completion have little opportunity to make cumulative long-run family investments that contribute to college-preparedness. There would be little effect of the newly-acquired wealth on the college attendance of their children if college readiness and ability are the decisive elements in producing enrollment in college.

For lottery winners with young children, a much larger response to the lottery would be expected in terms of the college attendance of their children if parents invest in better schools and more academic opportunities for their children over a longer horizon. If short-term credit market constraints are the significant factor governing college attendance, then we expect a large response in college enrollments by children of previously poor families irrespective of the age of their children at the time the lottery was won.

If public policy aims to encourage college attendance, a focus on improving the environments of children and improving preparation for college will be more effective than grant or loan programs to economically or cognitively disadvantaged children in their late teenage years. What is known about cognitive ability is that it is formed relatively early in life and becomes less malleable as children age. By age 14, basic academic seem to be fairly well set. (See the evidence summarized in Heckman, 1995). Since scholastic ability promotes academic progress, early successful interventions in the life cycle of learning lead to higher overall achievement. By the time individuals finish high school and scholastic ability is determined, the scope of tuition policy for promoting college attendance is greatly diminished.

Only to the extent that the family income of able high school graduates falls below levels required to pay for college will short-term credit market constraints hinder college entry. Given the current college financial support arrangements that are available to low income and minority children in the U.S, the phenomenon of bright students being denied access to college because of credit constraints is an empirically unimportant phenomenon.

### **Tuition Costs and College Attendance**

It is easy to exaggerate the contribution of tuition costs toward explaining the gap in the college attendance of children from rich and poor families. Substantial loan and aid programs already exist that are targeted towards students from poorer families. At public two- and four-year institutions in the U.S. in 1996, average costs of tuition and fees were about \$2,300. To offset these costs, both the Pell grant and subsidized student



loan programs are available to children of low income families. Eligibility is determined by actual college costs and an estimated parental contribution that depends on travel expenses and allowances for miscellaneous expenses, the student's dependency status, family income and assets, and the number of other children the family has in college or postsecondary vocational training programs. In 1997, a first-year dependent college student is eligible for a maximum of about \$8,000 in Federal grants and subsidized loans. No minimum contribution toward estimated college costs is required from the student or the parents. In round figures, the \$8,000 maximum benefit consists of \$2,500 in Pell grants, \$2,500 in Stafford loans, and \$3,000 in Perkins loans. The maximum rises to \$11,000 for third and fourth year college students as subsidized loan limits rise.

A host of other Federal programs direct money to students in some form or another. In 1996, total institutional subsidies alone were approximately the size of the entire Pell grant program (The College Board, 1997).

Discussions of college tuition policy focus too often on the elite public and private institutions and ignore the broad spectrum of community colleges and public four year colleges that are available to students. They often overlook the rapid growth of community colleges in the past 25 years. About half of all current college students are in community colleges. These colleges offer low tuitions (typically about \$1300 per year in 1997 dollars) and flexible schedules that allow students to work and attend college. There are many more community colleges (1036) than four year colleges (604) and most prospective students have one nearby so access to them is not a serious problem. Costs of room and board can be avoided by living with parents. Evidence reported by Kane and Rouse (1995) suggests that the economic return to a year at a community college is the same as the economic return at a four year college. Taken at face value, their evidence suggests that there is no compromise in generating earnings by attending a community college for the first two years of the college experience.

The growth in community colleges is an institutional response to the rigid schedules,

high tuition costs and lack of access characteristic of four year schools. Many of the arguments currently made about the costs of attending college were more valid 25 years ago than they are now. In the current environment, with the institution of the community college in place, and with generous loan and grant programs available, the arguments that tuition costs and commuting are major barriers to college attendance by the poor are implausible.

To strengthen this argument, note that the take-up rate on Pell Grants and Perkins Loans targeted towards students from low income families is low (See Orfield, 1992). Many more funds are available than are spent. Binding borrowing constraints are not a plausible explanation for the lack of utilization of these resources. It is more likely 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.

#### **Some Evidence on the Unimportance of Short-Term Credit Constraints**

I now pose and answer two questions: (1) Which factors have the most influence on schooling attainment? and (2) Is the estimated influence of family income on college attendance a consequence of long-run family effects or short-term borrowing constraints?

To answer these questions, I compare the estimated effects of family background and family on college attendance when scholastic ability (AFQT) is included as an explanatory variable in a statistical analysis and when it is not. Measured scholastic ability is the outcome of long-term family and environmental factors produced in part from 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 into an analysis of college going, 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.

Table 2 presents a summary of a recent study conducted with Steve Cameron of Columbia University. Using a subsample of the NLSY data on youth with AFQT measured before high school graduation, we examine what portion of the gap in college attendance

between minority youth and whites is due to family income, to tuition costs, and to family background. Not controlling for ability measured at an early age, about half (5 points) of the 11 point gap between black and white college attendance rates is due to family income; more than half (4 points) of the 7 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 11 point black-white gap is explained for family income. For hispanics, the gap actually widens when family income is included. Equalizing ability more than accounts for minority-majority college attendance gaps. (See line 5) Similar differences show up in high school graduation rates and overall college attendance rates that do not condition on high school graduation. (See evidence in Cameron and Heckman, 1998.) Ability produced by families and environments accounts for pronounced minority-majority differences in schooling attainment, and not financial resources. The disincentive effects of college tuition on college attendance are dramatically weakened when ability is entered into the analysis of college attendance. This analysis suggests that it is long run factors that shape ability, not short term borrowing constraints, that explain the evidence in Figure 2. Programs that operate late in the life cycle are likely to be ineffective in promoting college attendance and wasteful of public funds.

Additional evidence in support of this point is provided by Brooks-Gunn and Duncan (1997). See Table 3. They establish that family income received at early ages is a much more important determinant of completed schooling - not income received during high school or in the college going years. This relationship holds up even when the same parental background factors are entered in an empirical analysis. This evidence is entirely consistent with the notion that it is college readiness - and not credit constraints - that explain income-college going relationship in Figure 2. It is also consistent with the importance of early interventions in promoting skill formation which I discuss in Section V.

### **III. Primary and Secondary Schools**

State and local governments heavily subsidize primary and secondary education. Virtu-

ally all direct operating costs are completely subsidized through high school; only the opportunity cost of the students' time remains unsubsidized. Many have questioned whether the amounts spent are adequate. Should teachers be paid more? Should class sizes be reduced? Many read the latest evidence from the Tennessee Star experiment as suggesting that class size reductions promise big gains in test scores. Test scores are commonly used to guide the success or failure of educational reforms. Yet the link between test scores, especially those measured in the early years of schooling, to later outcomes is at best weak. (Cawley, Heckman and Vytlačil, 1999). Fortunately, in recent years, a series of studies have appeared that link measures of schooling quality to measures of lifetime earnings and lifetime occupational achievement.

From this literature, there is a growing consensus indicating that within current ranges in most developed economies, that measured inputs such as class size and spending per pupil have little, if any, effect on the future earnings of students. (See Heckman, Layne-Farrar, and Todd, 1996, and Card and Krueger, 1996.) The most optimistic estimates show a mere 1-2% rise in future earnings for every 10% increase in per-pupil spending; however, even those estimates have been shown to depend crucially on ad hoc assumptions made by researchers. When those assumptions are relaxed, the effects of variation of per pupil spending and class size around sample means are small and poorly determined. (Heckman, Layne-Farrar, and Todd, 1996).<sup>5</sup>

Even if we take the most favorable estimates from the literature and combine them with the best case scenario for the costs of raising schooling quality at the secondary level, increasing spending per pupil is not a wise investment. Table 4 presents estimates of

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<sup>5</sup>Hanushek (1998) carefully examines the evidence from the widely celebrated STAR program on the effect of reducing class size on test scores of primary school children and finds little evidence for a strong effect of the program except on kindergarten children. The evidence on the STAR program supports the case for early interventions that is discussed below and not the case for a wide scale expansion of class sizes at all ages. Krueger (1998, personal communication) shows that the costs and benefits of STAR are about equal and there is little expected gain from the program in terms of its likely effects on the earnings of participants.

the discounted returns to schooling quality using the estimates of the quality-schooling relationship presented by Card and Krueger (1992a). The evidence in the table indicates that in the U.S. we may be spending too much on students. Taking a high estimate (relative to the literature) of a 2% increase in future earnings for a 10% rise in per pupil spending, yields a negative net return of such expenditure increases for all schooling levels. For high school graduates, the net loss is about \$3,800, and for college graduates the net loss is over \$4,400. Unless the same increase in spending raises future earnings by 5% or more per year, a number far higher than produced by any study in the literature, the financial costs of school quality far outweigh the returns.<sup>6</sup> In order to justify additional spending on primary and secondary schools, we would need to appeal to other social benefits that are not captured by earnings.

This evidence does not prove that school quality does not matter. Surely, it does. We know that increasing it from very low levels, it matters greatly. But, there is little evidence that marginal improvements from current levels of schooling quality are likely to be effective. 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. While the effects of quality vary across environments and additional funding for some schools may be justified, more fundamental changes are required if we hope to see a significant improvement in our educational system.

### **The Benefits of Competition and Incentives**

It is widely perceived that American primary and secondary schools are failing. The evidence for this failure is the dismal ranking of American high school students on standardized achievement tests compared to the performance of students from other nations. There is slow growth in achievement test scores, and in the recent past there have been periods of decline in scores in the face of rising real per pupil expenditures (See Hanushek,

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<sup>6</sup>This calculation was suggested to me by Sam Peltzman. Recall further that Heckman, Layne-Farrar and Todd (1996) demonstrates that fragility of the Card-Krueger estimates.

1998). As a nation, Americans are spending more and more on public schools and apparently getting little in return for all of this expenditure, at least using one widely used measure of schooling output.<sup>7</sup>

A sharp contrast is often made between the poor performance of public secondary schools and the high level of performance of the American college system. Students from around the world flock to the U.S. to study in our colleges and graduate schools yet our secondary schools appear to be second rate. How can we reconcile the apparently contradictory story that our high schools are mediocre and our colleges are first rate?

The answer lies in part in the way public schools are currently organized. Public school systems in the U.S. are local monopolies with few competitors. The American high school system is a creation of the 20th Century and is a world unto itself. Within it, an artificial adolescent culture is left to flourish which often discourages academic achievement and the pursuit of knowledge even in the best schools in the best neighborhoods (Coleman, 1961). The incentives of many principals and teachers to produce useful knowledge, or any knowledge at all, are weak although there are surely many dedicated professionals. They 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. The educational technocrats dismiss such evaluations as "subjective" and unreliable. The parents and students in these schools have limited ability to act on their valuable private information about bad teachers and bad schools. Poor families have only limited ability to choose alternative teachers and schools.

An emerging body of hard evidence indicates that competition and choice improves

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<sup>7</sup>Other relevant outputs of schooling such as motivation and self-discipline are not measured by these test scores. Casual empiricism suggests that with discipline and self motivation have declined among American high school students but I know of no hard evidence on this question.

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 (1999) has demonstrated 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. See her evidence summarized in Table 5.

Derek Neal (1997) demonstrates that the higher achievement scores of Catholic school students compared to public school students demonstrated by Coleman and his associates (1981; 1987) is a largely 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 centralized inner city schools.

Everywhere it has been investigated, the effects of competition in education and training (and in virtually every other sector of life) are beneficial for the students and trainees. For example, the celebrated German Apprenticeship System has been recommended as a model for the U.S. and for many other countries. That system gives high school age students the choice of integrating work and learning as an alternative to strictly formal academic education. When stripped to its essentials, the German system differs from the U.S public school system by (a) breaking down the artificial separation between the world of work and the world of learning; (b) giving students and the firms that apprentice them choice among a variety of learning situations and (c) motivating students to perform well in order to secure the most desirable apprenticeships and motivating many firms to provide valuable training opportunities. The high level of competition among firms offering apprenticeships and among students is a major source of its success. (See Heckman, 1994 and Heckman, Roselius and Smith, 1994).

Once it is recognized that the public schools, especially inner city public schools, are a

virtual monopoly, while the U.S. university system is highly competitive, the mystery of the poor performance of the former, and the great success of the latter vanishes. (See Hoxby, 1998). It is remarkable in a society as committed to consumer sovereignty and choice in most aspects of economic and social life as the American society, that there is so much resistance to permitting choice and instituting incentives in education. The conventional argument of the educational planners is that parents and students are not able to make wise choices. All the evidence points to precisely the opposite conclusion.

Recent research, to which I turn next, suggests that the early years of childhood prior to schooling are crucial for later success in schooling and life. If parents cannot make wise choices about the schooling of their children, how can we trust them to make the right choices for their children in the preschool years? The logical extension of the paternalistic argument that denies parental sovereignty in schooling would suggest that the state should play a far more active role in the preschool life of the child as well, a position few would be willing to accept.

I reject the paternalistic argument for most groups. However, for certain disadvantaged families such interventions may be appropriate. If we are to violate the principle of consumer sovereignty anywhere in the life cycle process of learning, the case for doing so is strongest at the preschool stage for some groups and not at later stages of formal schooling where the argument for paternalism is most often made. Dysfunctional families and environments are a major source of social problems. Paternalistic interventions into the lives of severely deprived children in disadvantaged environments may be warranted. On what evidence do I base these remarks? What is the case for early intervention?

#### **IV. Early Childhood Investments**

Recent studies of early childhood investments have shown remarkable success and indicate that the early years are important for early learning and can be enriched through external channels. Early childhood interventions of high quality have lasting effects. Disadvantaged subnormal IQ children randomly assigned to the Perry Preschool program were



administered intensive treatment at ages 4-5. Treatment was then discontinued and the persons were followed over their life cycle. These people are now about 35 years old. Evidence on them indicates that those enrolled in the program have higher earnings and lower levels of criminal behavior in their late 20s than do comparable children randomized out of the program. Reported cost-benefit 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. As with the Job Corps, a substantial fraction (65%) 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 through age five. Reductions in problems with probation and criminal offenses ten years later were as large as 70% among children randomly assigned to the program. Girls who participated in the program also showed greater school achievement (Lally, Mangione, and Honig, 1988). Studies of early intervention programs have found short-term increases in test scores, less grade retention, and higher high school graduation rates among enrolled children. Of those studies that examine pre-delinquent or criminal behavior, most have found lower rates of deviant behavior among program participants. See Table 6 for a summary of the effects of selected early intervention programs on student test scores, schooling, earnings, and delinquency and Tables 7A and 7B for a summary of the Perry Preschool findings.

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) found short-term gains in test scores for all participating children; however, most of those gains decayed quickly for African-American children. They conclude that either differences in local program administration or in subsequent schooling quality are at the root of the differences between the outcomes for black and white children. Ramey et. al note (1998) that the schools attended by the Perry preschool children were of

substantially higher quality than those attended by the typical Head Start child. Thus, the failure to maintain the initial positive stimulus of Head Start may account for the decline in its impact over time.

It is important to note, however, that similar declines in test scores were found for programs like Perry Preschool, but their long-term evaluations are quite favorable. 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 this program do not imply that long-term beneficial effects of Head Start are not present. Head Start may improve the lifetime prospects of its participants, despite yielding only short-term gains in test scores.

However, there is some evidence that Head Start may have smaller long-term impacts than more intensive programs. Studies of Head Start's impact on special education placement and grade retention have produced less dramatic results than have been achieved from smaller demonstration projects like the Perry Preschool Program (Haskins, 1989). This is not surprising given the much lower spending per child and quality of service provided by the Head Start program. Unfortunately, there are no reliable long-term evaluations of the Head Start program that link interventions to conventional socioeconomic outcome measures like occupations and earnings.

The weaknesses of Head Start can be attributed to its shorter period of intervention, lower intensity, and less qualified staff than is typical of more enriched programs (Zigler, 1994). With Head Start, as with most other things in life, you get what you pay for. For example, children enrolled in the Perry Preschool program received high quality full-time preschool services for 1-2 years (most received two years), and their parents benefited from weekly home visits by their children's teachers.

The intervention affected both children and the parents. Parents improve their education and labor force activity and reduce their participation in welfare. The successful enriched programs like Perry Preschool foster long term improvements in the home envi-

ronment which carry over to the child long after the program has terminated. Head Start offers a much lower quality (and lower paid) staff, 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 (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 recently published by John Donohue and Peter Siegelman (1998) indicate that if enriched early intervention programs were targeted toward high risk disadvantaged minority male youth, the substantial costs of these enriched programs evident in Table 6 would be more than repaid by the expected savings in incarceration costs alone.

An important lesson to draw from the Perry Preschool program, and, indeed the entire literature on successful early interventions, is that it is the social skills and motivation of the child that are more easily altered - not IQ. These social and emotional skills affect performance in school and in the workplace. As academics, we have our own 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 early interventions to be ineffective.

Yet the evidence from the Perry Preschool program and the evidence in Table 6 reveals that these programs are highly effective in reducing criminal activity, promoting social skills and integrating disadvantaged people into the mainstream society. The greatest benefits of these programs are on socialization and not IQ. Social skills and motivation have large payoffs in the labor market so these programs have the potential for a large payoff.

I next turn to the evidence on the effectiveness of interventions for older children.

## **V. 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? This question is relevant because cognitive abilities are fairly well determined or stable by age 8-9 in the sense that IQ is highly correlated at successive ages beyond that age range. Just as the early intervention programs have a high payoff primarily due to the social skills and motivation imparted to the child, and the improved home environment, so do interventions that operate during the adolescent years, and for much the same reasons.

Table 8 summarize evidence on the effects of adolescent interventions on education, earnings, and crime rates. Both school-based and training-based programs are compared. I briefly discuss what is known about school-based interventions during the adolescent years before I turn to a discussion of training programs for youth and other persons in Section VI.

A few recent studies of mentoring programs, like the well-known Big Brothers/Big Sisters (BB/BS) and the Philadelphia Futures' Sponsor-A-Scholar (SAS) programs, have shown broad positive social and academic impacts on participating school-age 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 and promotes private youth development. 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 18 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. See Table 9.

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. In many ways, individually matched mentors serve as surrogate parents, providing a successful role model, monitoring student progress, and providing other social 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 30 students to ensure a successful relationship is built between mentors and mentees. Using a matched sample of non-SAS students in Philadelphia high schools,<sup>8</sup> Johnson (1998) estimates statistically significant increases in GPA for tenth and eleventh grades, as well as a 22% (16%) increase in college attendance one year (two years) after graduation from high school (Table 9). Because the primary goal of SAS was to increase college enrollment, other social and psychological measures were not studied.

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 dropped out of school or not. 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 their GED) than similar non-participants. Since many participants were enrolled in post-secondary schooling at the time of the follow-up study, it is difficult to determine the program's effect on earnings.

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<sup>8</sup>Comparison students were matched with participants on the basis of race, gender, school attended and ninth grade academic performance.

However, arrest rates for program participants were one-half those for non-participants. These benefits did not come without cost, 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. Table 10 presents the evidence from a randomized trial evaluation of the Quantum Program. Again, the evidence is that these programs can dramatically improve social skills and the adaptation of persons to the society.

Two other studies provide additional evidence that creative programs designed to keep adolescents in school can be effective. 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 non-enrollment). 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. For 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), there is a cause for concern that participants may have substituted GED training for high school graduation as an easier means for meeting program requirements.<sup>9</sup> 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. A key finding from both of these studies is that they show more positive impacts for individuals still enrolled in school (when compared with dropouts).<sup>10</sup> It is still unknown whether that is because, on average, they are of higher

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<sup>9</sup>Cameron and Heckman (1993) have shown that a GED commands lower wages than a high school diploma in the labor market.

<sup>10</sup>See Granger and Cytron, 1998 for a summary of both.

ability than those who have already dropped out, or because there is some advantage to intervening before adolescents leave school. (See the evidence summarized in Table 11).

The three programs just discussed demonstrate that financial incentives to stay in school and participate in learning activities for disadvantaged students can increase schooling and improve employment outcomes. It should be noted that while these programs proved to positively influence employment and earnings (and, in the case of QOP, reduce crime), they do not perform miracles. Impacts are modest, but positive.

Two other programs are worth discussing. 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. While the program achieved modest short-term gains in reading and math skills, those gains did not last. Two to three years after program completion, there were no effects on high school graduation rates, grades, or employment. One criticism of the program was that it did not attempt 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. While the program did not reduce final dropout rates, it did seem to delay dropout (dropout rates were lower during the 9th grade but not by the end of the 12th grade). The program also increased the pass rate for 12th grade students taking the Maryland Functional Tests (a basic skills test).

These programs suggest that sustained interventions targeted at adolescents still enrolled in school can positively impact learning and subsequent employment and earnings.<sup>11</sup> These studies also suggest that interventions for dropouts are much less

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<sup>11</sup>See the report entitled "What's Working (and What's Not)?" by the U.S. Department of Labor (1995) for a more comprehensive survey of programs aimed at increasing the skills and earnings of disadvantaged youth.

successful. Unfortunately, they do not tell why. We do not know whether there is some advantage to intervening before the dropout decision is already made, or if 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).

We next turn to the evidence on more traditional job training programs. Can they convert unskilled adults into skilled workers efficiently?

## **VI. The Effectiveness of Public Sector Training Programs**

Due to 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 understood 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. In comparison with studies of public sector training, most of these studies do not attempt to control for fact that more able persons are more likely to take training, so the estimated rates of return would overstate the true returns to training by combining them with the return to ability. Thus, part of the measured return may be due to more motivated and able persons taking training. Estimated initial returns range from 10 to 20% (Mincer, 1993). (See Table 12).

An important feature of private sector training is that the more skilled do more investing even after they attain high skill levels. Different types of training and learning have strong complementarities with respect to each other. To the extent that effective training can be produced on the job, it is produced in the private sector and not in the public sector. The best hope of getting a reasonable return from job training is to encourage private sector investment. Firms are also more sensitive to changing market demands for skills than are government bureaucracies.

It is important to note, however, that private sector training typically excludes low-skilled persons. Firms can be exclusive in a way 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 training programs are an inefficient transfer mechanism and an inefficient investment policy for low-skill adult workers.

### **Evidence About Conventional Public Training and Work-Welfare Programs**

How ineffective are current programs in moving people from welfare to work and in increasing their employment and earnings? Generally they are very ineffective. They cannot be expected to produce anywhere near the 10% rate of return that I used in my initial calculations in this lecture. Consider the evidence for various groups.

#### **Adult Women**

Employment and training programs increase the earnings of adult female AFDC recipients. Earnings gains (a) are modest, (b) persist over several years, (c) arise from several different treatments, and (d) are sometimes quite cost effective. Table 13 displays evaluation results for a variety of programs. For example, participation in an Arkansas job search program was required for AFDC recipients with children over age three. Participants attended a group job search club for two weeks and then were asked to search as individuals for an additional two months. A program in San Diego required all AFDC participants to take job search assistance and mandated work experience. The gains were high for participants in both programs. The National Supported Work program provided intensive training and job search assistance at a cost of about \$16,550 per recipient. The estimated rate of return to this program was only 3.5%.

The results from the recent experiment evaluating the Job Training Partnership Act shown in Table 14 corroborate these findings. The largest impacts are for adult women, many of whom were collecting AFDC during their participation in JTPA. However, the impacts are not sufficiently large to move more than a tiny fraction of women out of poverty. As a general rule, conventional employment and training programs are often cost effective for adult women (especially if the opportunity cost of trainee time is ignored or is sufficiently low), but do not produce dramatic changes in participant earnings or employment.

#### **Adult Men**

The evidence for this group is consistent across programs. Returns are low but usually positive. Job search assistance is an effective strategy but produces only modest increases in mean earnings levels. For these groups, training programs will not make much of a difference in closing the wage gap between the skilled and the unskilled.

The only exception to this generally poor performance of publically provided training is in classroom training. Heckman, Hohmann, Khoo and Smith (1999) demonstrate that the return to classroom training provided by government training programs is comparable to that provided by the ordinary educational sector for average students.

### **Youth**

Evidence from the recently concluded JTPA experiment indicates that this program produces only low or negative impacts on earnings. For male youth, the estimated negative effect is unbelievably low. If taken seriously, participation in JTPA has a more negative impact on the earnings of male youth than participation in the Army, loss of work experience or the cost of incarceration as measured by many studies.

The New Chance program, operating in 10 different states, provides equally pessimistic results for teenage mothers. This program was voluntary for young single mothers ages 16-22, who were on welfare, had dropped out of high school, and had not yet received a high school diploma or GED. New Chance offered a comprehensive set of services to these mothers and their children, including instruction in basic skills and in subjects related to the GED, occupational training, work experience, and job placement services. The program increased the proportion of young mothers receiving a high school diploma or GED by 8.1%. However, that increase came entirely from an increase of 11.8% in GED recipients. In fact, program participants were less likely to receive a high school diploma than non-participants! There were no long-term impacts on earnings or employment (Quint, Bos, and Polit, 1997, and Granger and Cytron, 1998). Two primary differences between this program and those just described are immediate. First, participants had already dropped out of school by the time they entered the program. The impacts for TPD and LEAP were

much smaller (and mostly insignificant) for dropouts than for individuals still enrolled in school. Second, New Chance was a strictly voluntary program which attempted to induce welfare teenage mothers to enroll based on program benefits, while QOP, TPD, and LEAP provided financial incentives to encourage academic activities.

Only the Job Corps has a demonstrated positive impact on earnings. It is an expensive program, costing around \$20,000 per participant, with an estimated return of roughly 8-9%. There is some basis for supporting expansion of this program, but even for this program the evidence is weak. Part of the high return comes from the very large value imputed to human life and the slightly smaller rate of committing murders found among persons who participate in the Job Corps. With lower values placed on lives saved, the estimated gains from Job Corps are much smaller. (See Donohue and Siegelman, 1998).

Jobstart was designed to achieve similar impacts to the Job Corps, without the associated costs. It offers less intensive services in a non-residential setting, at a cost of about \$6,000 per participant (substantially more than JTPA training, but less than half the cost of the Job Corps). Not surprisingly, the savings in costs are matched by a reduction in impacts. While estimates suggest small increases in earnings and education and reductions in crime, those effects were typically not statistically significant for the overall sample of participants. Two particularly problematic subgroups showed large positive impacts on earnings: men arrested between age 16 and program entry and youth who had dropped out of school for educational reasons. Previous arrestees also showed some evidence of reduced crime and drug use as a result of the program. More surprising, however, is the sizeable impacts reported by one program site - the Center for Employment and Training (CET) in San Jose, California.

The CET provides 3-6 months of vocational training to disadvantaged youth and adults, most of which are high school dropouts. At a cost of \$4,200 per enrollee, the program showed sustained earnings gains of over \$3,000 per year (a 40% increase)! The success of this program is not entirely understood, but it does have a few distinguishing features which

are suggestive (U.S. Department of Labor, 1995). First, the program has close ties to the local labor market. An industrial advisory board is set up to aid in skill selection; courses are taught by technicians from industry; and many area employers are on the advisory board. Second, CET emphasizes job skills training over learning basic skills. Basic skills are taught in the context of job training. Third, the CET curriculum is tailored specifically to the needs of each participant. Fourth, the CET has been active in San Jose for over 25 years and program staff have extensive local knowledge and contacts. It has earned a positive reputation among employers, which is likely to help the placement of new graduates.

### **Training Programs for Displaced Workers**

Displacement of older workers with substantial experience in the labor market has become an increasingly important phenomenon in recent years. In response to this trend, Congress passed Title III of the Job Training Partnership Act in 1982 and the Economic Dislocation and Worker Adjustment Assistance Act in 1988.

Leigh (1990) summarizes the evidence on a variety of these programs. Results from some of these evaluations suggest small to moderate wages gains lasting only about a year. A more recent evaluation by Mathematica (see Corson, et al., 1993) of training provided under the Trade Adjustment Assistance Act to workers displaced as a result of foreign trade finds no evidence of any effect of this long-term training program on the earnings and employment of recipients. Consistent with the other studies of government employment and training programs already discussed, the overall pattern for programs aimed at displaced workers is one of weak impacts for most groups. This is in sharp contrast to the high rates of return for private on-the-job training.

We cannot rely on Federal job training programs to convert adult unskilled workers into the skilled workers demanded by the modern economy either in the U.S. or in any other country where their track record is equally poor. (See, Heckman, LaLonde and Smith, 1999 for a survey of impacts of job training programs around the world).

### **Summary of Training Impacts**

A comparison of these programs suggests a few important lessons. First, you get what you pay for. The JTPA program generally costs very little and produces very little. The intensive residential nature of the Job Corps was not easily replaced by the less expensive Jobstart program (with the exception of CET). Second, the effects of treatment may vary substantially among subgroups. This is not only evidenced by the difference in effects for the JTPA across age and sex classifications, but it is also observed for subgroups in the Jobstart evaluation. Third, these types of programs also affect behaviors beyond schooling and work which should be considered. Both the Job Corps and Jobstart suggest that reductions in crime may be an important impact of programs targeted at male youth. Fourth, programs that are highly integrated with the local labor market and private sector are likely to be the most successful. This supports our claim that efforts should be made to shift training subsidies to the private sector. It also reinforces the point I made about the German Apprenticeship System. It is effective in part because it tightens the link between the workplace and the school room. 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 the 10% figure I used in my initial calculations and is sometimes negative.

## **VII. Tax Policy**

The final type of policy I consider is tax policy. Aside from the progressivity of the current tax system, tax rules in the United States tend to promote human over physical capital formation (Quigley and Smolensky, 1990). There is some evidence that tax laws are more favorable towards investment by more skilled and wealthier workers, although there are elements in the tax code that favor low- skill workers as well. 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. While many of the effects of the current tax system on human capital investment may be unintended, those effects can be substantial and favor certain workers as well as certain types of investment over others.

In order to understand how taxes influence human capital investment, it is helpful to understand its costs and returns. The costs of investment 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 where the only 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 which are not tax deductible, a higher tax rate discourages investment, because it lowers the returns to investment more than the costs. In the case of a 10% increase in the tax rate, the return to investment falls by 10%, the cost of foregone income declines by 10%, but the tuition cost remains unchanged if tuition cannot be deducted, as it cannot be in the U.S. tax system. Thus, the return 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 are foregone earnings, which are tax deductible. If tax rates are 10% and you earn \$10 less, you pay \$1 less in taxes—the net loss is only \$9. The costs of other inputs to on-the-job training can typically be expensed by the workers employer 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. While this cost is substantial for some, a majority of youth do not attend college, and a majority of those who do 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. (Estimated inter-temporal labor supply elasticities are small and welfare effects from labor supply adjustment are negligible.

In a modern society, where human capital is a larger component of wealth than is land, a proportional tax on human capital is a non-distorting Henry George tax. Taxes on it should be increased while taxes on capital should be decreased in order to promote wage growth and efficiency.

However, the current U.S. tax system is not flat. The progressivity in the tax schedule will tend to discourage human capital investment. For some individuals, the gain in earnings resulting from human capital investment causes them to move up tax brackets. In this case, 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 where the only cost of investment is foregone earnings. Suppose an individual's current marginal tax rate is 10%. If he chooses to invest, his increased earnings will cause him to switch to a marginal tax rate of 20%. In this case the returns are taxed at the 20% level, but the costs are deducted at the 10% 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 lower. Changing the tax on interest income can have a beneficial effect on both capital accumulation and on real wages.

Heckman, Lochner and Taber (1998, 1999) and Heckman (1999), estimate that for the U.S. economy a revenue neutral move to a flat tax on consumption in the steady state raises the wages of both skilled and unskilled workers, raises aggregate output by 5% (and aggregate consumption by 3.7%) while raising the wages of college graduates and high school graduates equally (7%). Such a move will barely affect overall inequality

while promoting greater levels of both human capital and physical capital. (See Table 15 taken from Heckman, Lochner and Taber 1999). However, the real effect of these reforms is on physical capital, and its feedback effects on wages. The effects on human capital accumulation of these reforms are small. Tilting the bias in the tax system toward capital and away from human capital will improve the earnings of both capital and labor in the long run.

Such tax reforms are usually either ignored or misrepresented in popular discussions. Politicians 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.

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, investment costs are typically financed through foregone earnings. To the extent that formal educational expenses are not paid for this way, they can be deducted from gross earnings provided that they are itemized and that itemizations from all sources exceed 2% of adjusted gross income. This feature of the tax code tends to favor high-skill individuals who are more likely to itemize expenses.

Since 1986, individuals have been unable to deduct interest paid on educational loans from their taxable income. The disincentive effects of this exclusion can be substantial. While individuals must pay taxes on interest from savings, they cannot deduct the interest they pay on educational loans. However, mortgage interest is still deductible. It is possible for families with home equity to take out mortgages to finance their childrens education, and there is some evidence that post-1986 families have done so. 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 policy that only allows mortgage interest to be deducted.

The tax system favors public schooling investment at the primary and secondary level



over private schooling and any type of post-secondary schooling. Any student can attend public elementary and high school for free and the costs of those public schools are financed primarily through local and state taxes, which are fully deductible. However both private school and college tuition is not deductible, 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, communities have incentives to set up good public schools 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 for by employers from personal income tax, provided the schooling is job-related. Portable vocational or employer-based training can be sold to employees by firms and paid for by lower wages. The foregone earnings are essentially written-off on personal income taxes. Individuals seeking training are, therefore, encouraged to look to their employer rather than formal schools. In addition, training and schooling expenditures that are not job-related can be immediately written-off by firms up to \$5,250 per year for each worker. However, tuition support is restricted to undergraduate level education (U.S. House of Representatives, Joint Committee on Taxation, 1992). Again, this shifts schooling and training to the workplace environment.

Relative to physical capital, some types of human capital investment are favored by the tax system, while others are not. To the extent that many human capital investments

are immediately tax-deductible while physical capital investments must be amortized, the current tax system encourages human over physical capital investment. In cases where schooling or training costs cannot be deducted – primarily tuition costs for formal schooling – investment in physical capital is favored. While it is ambiguous as to who current tax provisions benefit most – the most or the least skilled – employer provided training is certainly favored over training undertaken away from the workplace. This asymmetry of tax treatment is often justified by the argument that there is a much larger consumption value of academic education than job-specific training and that this consumption value should be taxed.

#### **VIII. The Conflict Between Economic Efficiency and the Work Ethic**

To the extent that there are strong complementarities between different types of skill investments, there is a conflict between policies that seek to alleviate poverty by investing in low- skill workers and policies that raise the wealth of society at large. Taking the available evidence at face value, the most economically-justified strategy for improving the incomes of the poor, especially adult low-ability low-skill persons is to invest more in the highly skilled, tax them, and then redistribute the tax revenues to the poor.

However, many people view the work ethic as a basic value 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. Higher subsidies induce people to switch out of criminal activities. However, job subsidies are not the same as investment subsidies. The evidence points strongly to the inefficiency of subsidizing the investment of low-skill, disadvantaged workers. Investment may have some additional non- pecuniary returns. In this case, a purely economic evaluation of investment policies may be inappropriate. If, however, economically inefficient investments are to be made, the cost of reducing the skill gap grows beyond the already

enormous sums presented in Table 1.

## **IX. Conclusion: A Life-Cycle Perspective**

In evaluating a human capital investment strategy, it is crucial to consider the entire policy portfolio of interventions together – training programs, school-based policies, school reform, and early interventions – rather than focusing on one type of policy in isolation from the others.

The best evidence suggests that learning begets learning. Early investments in learning are effective. Much of the recent emphasis on lower tuition costs for college students is misplaced when the value of early preschool interventions is carefully examined. In the long run, significant improvements in the skill levels of American workers, especially workers not attending college, are unlikely without substantial improvements in the arrangements that foster early learning. We cannot afford to postpone investing in children until they become adults, nor can we wait until they reach school age - a time when it may be too late to intervene. Learning is a dynamic process and is most effective when it begins at a young age and continues through adulthood. The role of the family is crucial to the formation of learning skills, and government interventions at an early age that mend the harm done by dysfunctional families have proven to be highly effective.

The returns to human capital investments are greatest for the young for two reasons: (a) younger persons have a longer horizon over which to recoup the fruits of their investments and (b) skill begets skill. Skill remediation programs for adults with severe educational disadvantages are much less efficient compared to early intervention programs. So are training programs for more mature displaced workers. The available evidence clearly suggests that adults past a certain age and below a certain skill level obtain poor returns to skill investment. A reallocation of funds from investment in the old and unskilled to the young and more trainable for whom a human capital strategy is more effective is likely to produce more favorable outcomes in the long run. Figure 1 succinctly states the argument. At current levels of investment, marginal returns are highest for the young.

Current training policies need to be re-considered. Private training programs have two

advantages that public training programs do not: they can train workers who are likely to benefit most, and they can tailor their training programs to market needs. While public training programs sometimes yield increases in participant earnings, those increases fall far short of those estimated for private training programs. To the extent this is true, incentives to promote private sector training should be expanded and ineffective public sector training programs should be re-evaluated and eliminated. Firms are likely to choose younger and more able workers to train, rather than expending resources on older and more difficult to train workers who will gain little from additional investments.

For older unskilled workers whose skills have been made obsolete by newer modes of production, wage subsidies offer a more efficient alternative for raising their incomes. (See the discussion in Phelps, 1997.) By encouraging work rather than unemployment and crime, wage subsidies may also provide social benefits that extend beyond individual increases in earnings.

All levels of government subsidize higher education, and those subsidies benefit both unskilled and skilled workers. The argument for increasing the current high level of subsidies however, is not well documented. The evidence that borrowing constraints are important deterrents to college attendance is very weak. Students from low-income families tend to have much lower college attendance rates for reasons other than their inability to meet tuition and living expenses. Lower family income levels are associated with less productive family and neighborhood environments as well as lower motivation and ability by prospective students. These are factors not so easily remedied by student loans or fellowships. The available evidence does not suggest that additional loans or subsidies are necessary to alleviate credit constraints. There is no evidence that suggests that massive externalities to education exist at current levels of subsidy that require an expansion of existing levels of subsidy to education (Heckman and Klenow, 1998).

Public primary and secondary schools are fully subsidized by taxes. The available evidence suggests that additional spending on public school quality would be inefficient.

Instead, reforms in the administrative structure of education and infusion of incentives and competition are far more likely to be effective.

Given the weak lifecycle labor supply responses reported in the literature. (See Browning, Hansen and Heckman, 1999) a proportional tax on human capital is a Henry George tax with no distorting effects on human capital accumulation. Reforms to eliminate progressivity in the tax system will have only small effects on human capital accumulation. Far more important for wage growth and economic efficiency are reforms in the taxation of capital. Promoting capital formation raises the real wages of skilled and unskilled workers with only slight effects on inequality in earnings.

## References

- Bartel, A., 1992. "Productivity Gains from the Implementation of Employee Training Programs," NBER Working Paper 3893.
- Bishop, J., 1994. "Formal Training and Its Impact on Productivity, Wages and Innovation," in L. Lynch, ed., *Training and the Private Sector: International Comparisons*. Chicago: University of Chicago Press.
- Bloom, H., L. Orr, G. Cave, S. Bell, and F. Doolittle, 1993. "The National JTPA Study: Title II-A Impacts on Earnings and Employment at 18 Months," Bethesda, Maryland: Abt Associates.
- Browning, M., L. Hansen and J. Heckman, 1999, "Microdata and General Equilibrium Models," in J. Taylor and M. Woodford, eds., *Handbook of Macroeconomics*, North Holland: Amsterdam.
- Callan, P., 1997. "Stewards of Opportunity: American's Public Community Colleges," *Daedalus*, 126(4), 95-112.
- Cameron, S. and J. J. Heckman, 1998a. "Life Cycle Schooling and Educational Selectivity: Models and Choice," *Journal of Political Economy*, April, 1998, (first presented at the University of Wisconsin, June, 1990).
- , 1999, "Can Tuition Policy Combat Rising Wage Inequality?" in M. Kosters, ed., *Financing College Tuition: Government Policies Social Priorities*, AEI Press, Washington, D.C.
- , 1997. "Dynamics of Schooling Attainment for Blacks, Whites, and Hispanics," Working Paper, (first draft, presented at NBER, April, 1992), revised, 1998.
- Card, D., and A. Krueger, 1996. "School Resources and Student Outcomes: An Overview of the Literature and New Evidence from North and South Carolina," *Journal of Economic Perspectives*, 10(4), 31-50.
- Cawley, J., J. Heckman and E. Vytlačil, 1999, "A Note on Policies To Reward The Value Added By Educators," *Review of Economics and Statistics*.

College Board, 1997. "Trends in Student AID: 1986-1996," Washington, D.C.: The College Board.

Coleman, J., 1961, *The Adolescent Society*, New York: Free Press.

Coleman, J., E. Campbell, C. Hubson, J. McPartland, A. Mood, F. Weinfeld and R. York, 1966. *Equality of Educational Opportunity*, Washington D.C.: U.S. Government Printing Office.

Coleman, J., S., Kilgore and T. Hoffer, 1981. "Public and Private High Schools," Washington, D.C., National Center For Educational Statistics.

-----, 1982, *High School Achievement*, New York, Basic Books.

Coleman, J. and T. Hoffer, 1987, *Public and Private Schools: The Impacts of Communities*, New York, Basic Books.

Corson, W., P. Decker, P. Gleason, and W. Nicholson, 1993. *International Trade and Worker Dislocation: Evaluation of the Trade Adjustment Assistance Program*, Princeton, N.J.: Mathematica.

-----, P. Decker, S. Dunstan, and S. Karachsky, 1989. "New Jersey Unemployment Insurance Reemployment Demonstration Project," *Unemployment Insurance Occasional Paper 89-3*, U.S. Department of Labor.

Currie, J., and D. Thomas, 1995. "Does Head Start Make a Difference?" *American Economic Review*, 85(3), 341-64.

Decker, P., and W. Corson, 1995. "International Trade and Worker Displacement: Evaluation of the Trade Adjustment Assistance Program," *Industrial and Labor Relations Review*, 48,758-74.

Donohue, John and Peter Siegelman, 1998. "Allocating Resources among Prisons and Social Programs in the Battle Against Crime," *Journal of Legal Studies*, Vol. XXVII(1), 1-43.

Gueron J., and E. Pauly, 1991. *From Welfare to Work*. New York: Russell Sage Foundation.



Hansen, L., 1983. "Impact of Student Financial Aid on Access," In *The Crisis in Higher Education*. Joseph Froomkin, ed. New York: Acad. Polit. Sci.

Hanushek, E., 1998. "The Evidence on Class Size" unpublished manuscript, W. A. Wallis Center, University of Rochester.

-----, 1997, "Budgets, Priorities, and Investment in Human Capital," in M. Koster, ed., *Financing College Tuition: Government Policies And Social Priorities*, AEI Press: Washington, D.C.

Haskins, R., 1989. "Beyond Metaphor: The Efficacy of Early Childhood Education," *American Psychologist*, 44(2), 274-82.

Hauser, R., 1993. "Trends in College Attendance Among Blacks, Whites, and Hispanics," in *Studies of Supply and Demand in Higher Education*. C. Clotfelter and M. Rothschild, eds. University of Chicago Press.

-----, 1991. "The Decline in College Entry Among African Americans: Findings in Search of Explanations," unpublished manuscript.

Heckman, J., 1976. "A Life Cycle model of Earnings, Learning and Consumption," *Journal of Political Economy*.

-----, 1994, "Is Job Training Oversold?" *The Public Interest*, Number 115, 91-115.

-----, 1995. "Lessons From the Bell Curve," *Journal of Political Economy*, 103(5), 1091-1120.

-----, 1996. "Should the U.S. Have a Human Capital Policy and If So, What Should It Be?" Gilbert Lecture, University of Rochester.

Heckman, J. and N. Hohmann and J. Smith with M. Khoo, 1999, "Substitution and Dropout Bias in Social Experiments: A Study of an Influential Social Experiment, forthcoming in *Quarterly Journal of Economics*.

Heckman, J. and P. Klenow, 1998. "Human Capital Policy," M. Boskin Editor, *Policies to Promote Capital Formation*, Hoover Institution.

Heckman, J., A. Layne-Farrar, and P. Todd, 1996. "Human Capital Pricing Equations

with an Application to Estimating the Effect of Schooling Quality on Earnings," *The Review of Economics and Statistics*, 78(6), 562-610.

Heckman, J., L. Lochner, J. Smith and C. Taber, 1997. "The Effects of Government Policy on

Human Capital Investment and Wage Inequality," *Chicago Policy Review*, Vol. 1(2).

Heckman, J., L. Lochner and C. Taber, 1998. "Explaining Rising Wage Inequality: Explorations With A Dynamic General Equilibrium Model of Earnings With Heterogeneous Agents," *Review of Economic Dynamics*, 1(1).

Heckman, J., R. Roselius, and J. Smith, 1994. "U.S. Education and Training Policy: A Reevaluation of The Underlying Assumptions Behind The New Consensus," in A. Levenson and L. C. Solomon, eds., *Labor Markets, Employment Policy and Job Creation*. Santa Monica: Milken Institute for Job and Capital Formation.

Herrnstein, R., and C. Murray, 1994. *The Bell Curve*, New York: The Free Press.  
Hollister, R., P. Kemper and R. Maynard, *The National Supported Work Demonstration*. Madison: University of Wisconsin Press, 1984.

Hoxby, C., 1999, "Where Should Federal Education Initiatives Be Directed? K-12 Education vs. Higher Education," in M. Koster, ed., *Financing College Tuition: Government Policies Society Priorities*, AEI Press, Washington, D.C.

Kane, T. and C. Rouse, 1995. "The Labor Market Returns To Two and Four Year College: Is A Credit A Credit and Do Degrees Matter?" *American Economic Review*.

Katz, L. and K. Murphy, 1992. "Changes in Relative Wages, 1963-1987: Supply and Demand Factors," *Quarterly Journal of Economics*; 107(1): 35-78.

Krueger, A., 1997. "What's Up With Wages?" *Goldman Sachs U.S. Economic Research*, November, 1-18.

LaLonde, R., 1995. "The Promise of Public Sector-Sponsored Training Programs," *Journal of Economic Perspectives*, 9(2) 149-68.

Lally, J., P. Mangione, and A. Honig, 1988. "The Syracuse University Family Develop-

ment Research Program: Long-Range Impact on an Early Intervention with Low-Income Children and Their Families," in D. Powell, ed., *Parent Education as Early Childhood Intervention*. Norwood: Ablex, 79-104.

Leigh, D., 1995. *Assisting Workers Displaced by Structural Change*. Kalamazoo, Michigan: W. E. Upjohn Institute for Employment Research.

-----, 1990. *Does Training Work for Displaced Workers?*, Kalamazoo, Michigan: W. E. Upjohn Institute for Employment Research.

Lillard, L. and H. Tan, 1986. *Private Sector Training: Who Gets It and What Are Its Effects?*, Santa Monica, California: Rand.

Long, D., C. Mallar, and C. Thorton, 1981. "Evaluating the Benefits and Costs of the Job Corps," *Journal of Policy Analysis and Management*, (1)81, 55-76.

Lynch, L., 1992. "Private-Sector Training and the Earnings of Young Workers," *American Economic Review*, 82(1).

-----, 1993, *Training and The Private Sector: International Comparison*, Chicago: University of Chicago Press.

Mincer, J., 1993. "Investment in U.S. Education and Training," Discussion Paper 671, Columbia University.

-----, 1962. "On the Job Training: Costs, Returns, and Some Implications," *Journal of Political Economy*, 70 (Suppl.) 50-79.

Mortensen, Dale, 1996. "The Unemployment Effects of Active Labor Market Policy: A US-UK Comparison" in *Mehr Wettbewerb, Mehr Arbeit - Ist Volbeschäftigung eine Illusion*, 157- 180, H. Von Drager, P. Pissula and A.W. Czege, editors, Nomos Verlags Gesellschaft, Baden.

Mortensen, Thomas, 1998. "Pell Grant Program Changes and Their Effects on Applicant

Eligibility, 1973-74 to 1988-89." Iowa City: American College Testing Program Research Report, No. 88-2.

National Center for Education Statistics (NCES), 1997. The 1997 Digest of Education Statistics.

Neal, D., 1997, "The Effects of Catholic Secondary Schooling on Educational Achievement," *Journal of Labor Economics*, 98-123.

Orfield, G., 1992. "Money, Equity, and College Access," *Harvard Educational Review* 7, 2(3), 337-372.

Orr, L., H. Bloom, S. Bell, W. Lin, G. Cave and F. Doolittle, 1995. *The National JTPA Study: Impacts, Benefits and Costs of Title II-A*. Bethesda, MD: Abt Associates.

Pawasarat, J. and L. Quinn, 1993. "Evaluation of The Wisconsin WEJT/CWEP Welfare Employment Programs," Milwaukee, Wisconsin: Employment and Training Institute, University of Wisconsin.

Phelps, E., 1997. *Rewarding Work: How to Restore Participation and to Self-Support Free Enterprise*. Cambridge: Harvard University Press.

Schweinhart, L., H. Barnes and D. Weikart, 1993. *Significant Benefits: The High/Scope Perry*

*Pre-School Study Through Age 27*, Ypsilanti, Michigan: High Scope Press.

Seitz, V., 1990. *Intervention Programs for Impoverished Children: A Comparison of Educational and Family Support Models*, *Annals of Child Development*. Vol. 7, London: Jessica Kingsley Publishers.

Zigler, E., 1994. "Reshaping Early Childhood Intervention to Be a More Effective Weapon Against Poverty," *American Journal of Community Psychology*, 22(1).

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**Table 1**

**Investment in Human Capital Required to Restore Earnings to 1979 Levels  
and to Restore 1979 Relative Wage Ratios  
Using a 10% Rate of Return  
(in billions of dollars)**

<i>To Restore Earnings to 1979 Levels</i>	
Males	
Investment needed to restore average male high school dropout earnings in 1989 to average real earnings of male high school dropouts in 1979	\$214
Investment needed to restore average male high school graduate earnings in 1989 to average real earnings levels of male high school graduates in 1979	<u>\$212</u>
<b>TOTAL</b>	<u><b>\$426</b></u>
<i>To Restore 1979 Earnings Ratios</i>	
Males	
Investment needed to restore average male high school dropout earnings in 1989 to the level needed to achieve the 1979 high school dropout/college earnings ratio (holding 1989 college graduate wages fixed)	\$382
Investment needed to restore average male high school graduate earnings in 1989 to the level needed to achieve the 1979 high school graduate/college earnings ratio (holding 1989 college graduate wages fixed)	\$770
Females	
Investment needed to restore average female high school dropout earnings in 1989 to the level needed to achieve the 1979 high school dropout/college earnings ratio (holding 1989 college graduate wages fixed)	\$136
Investment needed to restore average female high school graduate earnings in 1989 to the level needed to achieve the 1979 high school graduate/college earnings ratio (holding 1989 college graduate wages fixed)	<u>\$378</u>
<b>TOTAL</b>	<u><b>\$1.66 Trillion</b></u>

Source: Wages are from Blank (1994). We assume workers work 50 weeks a year. The figures on the educational breakdown for the labor force are from Table #616, *Statistical Abstract of the United States, 1992*. We delete all persons out of the labor force and those less than age 25. On these criteria, our estimated investment costs are downward-biased.

Table 2

Change in minority college entry probabilities at age 24 conditional on high school completion (minorities vs. whites)

	Without AFQT Score		With AFQT Score	
	Blacks (1)	Hispanics (2)	Blacks (3)	Hispanics (4)
(1) Equating All Family Background Components	.10	.11	.08	.05
Individual Components				
(1a) Number of Siblings	.03	.03	.02	.01
(1b) Highest Grade of Father	.08	.03	.06	.02
(1c) Highest Grade of Mother	.003	.05	-.005	.02
(1d) Broken Home	-.01	.01	-.002	.01
(2) Equating Family Income	.05	.03	.004	-.02
(3) Equating Local Average Wages	.004	.04	.002	.03
(4) Equating Tuition and College Proximity	-.03	-.05	-.02	-.05
(5) Equating AFQT Scores	na	na	.15	.12
(6) Equating 1 and 2	.14	.13	.08	.03
(7) Equating 1, 2, 3 and 4	.12	.12	.06	.01
(8) Equating 1, 2, 3, 4, and 5	na	na	.21	.13
(9) Gap between Whites and Minorities	.11	.07	.11	.07

Notes:

Source: Cameron and Heckman (1999).

Table 3

**Income Effects across the Life Span: Integration and Interpretation Effects of the Ages over Which Parents' Income is Measured on Children's Completed Schooling\***

Income Measure**	Parental Income Averaged over Ages				
	11-15	0-15	0-5	6-10	11-15
Average Income (\$10,000)	0.06*** (0.01)	0.11** (0.02)	0.14*** (0.04)	-0.02 (0.03)	0.04 (0.02)
Adjusted $R^2$	0.162	0.164		0.169	

Notes:

\*Standard errors in parentheses. All regressions include controls for mother's schooling, family structure, race, sex, and the age of the mother at the birth of the child.

\*\*Income inflated to 1992 price levels using the Consumer Price Index (CPI-UX1).

\*\*\*Coefficient is at least twice its standard error.

Source: Brooks-Gunn and Duncan (1997)



Table 4

School Quality  
Discounted Net Returns to Raising  
Spending Per Pupil by 10%

Education	Annual Rate of Return to Earnings			
	1%	1.5%	2%	5%
10yrs	-3,422	-2,987	-2,552	56
12yrs	-3,861	-3,366	-2,869	106
14yrs	-4,315	-3,800	-3,285	-196
16yrs	-4,523	-3,898	-3,273	476

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

Table 5

**Effects of Competition among Public School Districts<sup>1,2</sup>**

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Effect on Per Pupil Spending	17% decrease
Effect on Student Achievement as Measured by Test Scores	3-percentile point improvement
Effect on Student Achievement as Measured by Wages	4% increase
Effect on Student Achievement as Measured by Educational Attainment	0.4 additional years of education
Effect on Parents' Involvement in Their Students's School Career	30% increase in parents' visits to schools
Effect on Public Schools' Per-Pupil Spending	approximately 0
Effect on Achievement of Public School Students as Measured by Test Scores	8-percentile point improvement
Effect on Achievement of Public School Students as Measured by Wages	12% increase
Effect on Achievement of Public School Students as Measured by Educational Attainment	12% increase in probability of college graduation

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Notes:

1. Consider an increase of 1 standard deviation in the number of school districts in a metropolitan area or a decrease of 1 standard deviation in the concentration of enrollment among school districts in a metropolitan area.

2. Note that smaller effects are found for metropolitan areas in which school districts do not have financial autonomy (most revenue is state-determined).

3. Consider an increase in exogenous tuition subsidies of \$1000 or an increase in exogenous private school enrollment of 10%.

Source: Hoxby (1998).

Table 6

## Effects of Early Intervention Programs

Program/Study	Costs*	Program Description	Test Scores	Schooling	Pre-Delinquency Crime
Alphabetarian Project**		full-time year round classes for children from infancy through preschool	high scores at ages 1-4	34% less grade retention by 2nd grade; better reading and math proficiency	
Early Training** (Gray et al., 1982)		part-time classes for children in summer; weekly home visits during school year	higher scores at ages 5-10	16% less grade retention; 21% higher HS grad. rates	
Harlem Study (Palmer, 1983)		individual teacher-child sessions twice-weekly for young males	higher scores at ages 3-5	21% less grade retention	
Houston PDC**		home visits for parents for 2 yrs; child nursery care 4 days/wk in year 2 (Mexican Americans)	higher scores at age 3		rated less aggressive and hostile by mothers (ages 8-11)
Milwaukee Project** (Garber, 1988)		full-time year-round classes for children through 1st grade; job training for mothers	higher scores at ages 2-10	27% less grade retention	

Table 6 (continued)

Program/Study	Costs*	Program Description	Test Scores	Schooling	Pre-Delinquency Crime
Mother-Child Home Program (Levenstein, O'Hara, & Madden, 1983)		home visits with mothers and children twice weekly	higher scores at ages 3-4	6% less grade retention	
Perry Preschool Program** (Schweinhart, Barnes, & Weikart, 1993)	\$13,400	weekly home visits with parents; intensive, high quality preschool services for 1-2 years	higher scores in all studied years (ages 5-27)	21% less grade retention or special services; 21% higher HS grad. rates	2.3 vs. 4.6 lifetime arrests by age 27 7% vs. 35% arrested 5 or more times
Rome Head Start (Monroe & McDonald, 1981)	\$5,400 (2 yrs)	part-time classes for children; parent involvement		12% less grade retention; 17% higher HS grad. rates	6% vs. 22% had probation files; offenses were less severe
Syracuse University Family Development (Lally et al., 1988)	\$38,100	weekly home visits for family; day care year round	higher scores at ages 3-4		
Yale Experiment	\$23,300	family support; home visits and day care as needed for 30 months	better language development at 30 months	better-school attendance & adjustment; fewer special adjustment; school services (age 12 1/2)	rated less aggressive & pre-delinquent by teachers and parents (ages 12 1/2)

Table 7A

**PRESCHOOL EFFECTS RELATED TO ECONOMIC BENEFITS<sup>a</sup>**

OUTCOME VARIABLE	PRESCHOOL	(N)	NO-PRESCHOOL	(N)
Education Effects				
California Achievement Test at Age 9	172.8	(54)	145.5	(55)
California Achievement Test at Age 14	122.2	(49)	94.5	(46)
Classified Mentally Retarded <sup>b</sup>	15%	(54)	35%	(58)
Graduated from High School	67%	(58)	49%	(63)
Employment Effects				
Employed at Age 19	50%	(58)	32%	(63)
Monthly Earnings at Age 28	\$1,129	(54)	\$766	(61)
Crime Effects				
Arrested by Age 19	31%	(58)	51%	(63)
5 or More Arrests by Age 28	7%	(58)	35%	(63)
Welfare Effects				
Received Welfare at Age 19	18%	(58)	32%	(63)
Received Welfare at Age 28	59%	(58)	80%	(63)

Notes:

<sup>a</sup>All group differences statistically significant at .05 level.<sup>b</sup>At least one year in a classroom for "educably mentally impaired" children.

Source: Schweinkart, Barnes and Weikart (1993).

Table 7B

**PRESENT VALUE OF COSTS AND BENEFITS  
PER CHILD  
RECIPIENTS OF COSTS AND BENEFITS**

COST OR BENEFIT	WHOLE SOCIETY	PRESCHOOL PARTICIPANTS	GENERAL PUBLIC
Preschool Cost <sup>a</sup>	-\$12,356	\$0	-\$12,356
Measured Benefits			
Child Care	738	738	0
K-12 Education	6,872	0	0
College <sup>b</sup>	-868	0	-868
Adult Education	283	0	283
Employment <sup>c</sup>	14,498	10,269	4,229
Crime	49,044	0	49,044
Welfare	219	-2,193	2,412
Benefit Subtotal	\$70,876	\$8,814	\$61,972
Projected Benefits			
Earnings	15,833	11,215	4,618
Crime	21,337	0	21,337
Welfare	46	-460	506
Total Benefits	\$108,002	\$19,569	\$88,433
Net Present Value	\$95,646	\$19,569	\$76,077

Notes:

<sup>a</sup>Costs and cost increases appear as negative numbers.

<sup>b</sup>Some small portion of college costs are likely to have been borne by the participants, but these could not be estimated from the available information.

<sup>c</sup>The benefits reported include all costs paid by the employer to hire a participant. Allocation to participants and the general public assume that: a) the marginal tax rate is 25%, b) the value of fringe benefits received by the employee equals 10% of salary, and c) the value of other fringes paid by the employer (e.g., the employer's share of social security) equals 10% of salary.

Source: Schweinhart, Barnes and Weikart (1993).

Table 8  
Effects of Selected Adolescent Social  
Programs on Schooling, Earnings, and Crime

Program/Study	Costs*	Program Description	Schooling	Earnings*	Crime*
Job Corps (Long et al., 1981)	\$11,000	7 mo. of educ. and vocational training for 16-21 yr. olds (mostly male)	no effect	disc. pres. value of increased earnings of \$10,000	Estimated Reduction in crime valued at approx.
JTPA** (Bloom et al., 1993)	Males: \$1,316 Females: \$1,955	job training and placement services for adolescents	no effect	no effect	
STEP (Walker and Viella-Velez, 1992)		2 summers of employment, academic remediation & life skills for 14 & 15 year olds	short-run gains in test scores; no effect on school completion rates		
Quantum Opportunities Program** (Taggart, 1995)	\$10,600	counseling; educ., comm., & devp. services; financial incentives for part. (4 yrs. beginning in 9th grade)	34% higher HS grad./GED rates (2 yrs. post-program)	4% vs. 16% convicted; .28 vs. .56 avg. number of arrests (2 yrs. post- program)	

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



Table 9

Estimated Benefits of Mentoring Programs

Outcome Measure	Change
<b>Big/Brothers/Big Sisters</b>	
Initiating Drug Use	-45.8%
Initiating Alcohol Use	-27.4%
Number of Times Hit Someone	-31.7%
Number of Times Stole Something	-19.2%
<b>Grade Point Average (1-4 scale)</b>	
Skipped Class	3.0%*
Skipped Day of School	-36.7%***
	-52.2%***
Trust in Parent	2.7%**
Lying to Parent	-36.6%**
Peer Emotional Support	2.3%*
<b>Sponsor-A-Scholar<sup>a</sup></b>	
10th Grade GPA (1-100 scale)	2.9
11th Grade GPA (1-100 scale)	2.5
Percent Attending College (1 year after H.S.)	32.8%
Percent Attending College (2 years after H.S.)	28.1%

Notes:

Tierney and Grossman (1995) and Grossman and Johnson (1998)

\*Statistically significant at .10 level.

\*\*Statistically significant at .05 level

\*\*\*Statistically significant at .01 level

<sup>a</sup>For the Sponsored-A-Scholar program, only impacts that are statistically.

Table 10

The Quantum Opportunity Program: Second Post-Program Year Impacts

	QOP Participants	Control Group	Difference
<b>COMPLETION</b>			
Has high school diploma	63%	43%	+20%
Has GED certificate	25%	9%	+16%
<b>ENROLLMENT</b>			
Currently in 4-year college	23%	14%	+9%
Currently in a 2-year college	34%	11%	+23%
Currently in training	18%	2%	+16%
Currently in GED	4%	11%	-7%
Currently in college, training, or GED	78%	38%	+40%
<b>EMPLOYMENT</b>			
Currently employed full time	20%	7%	+13%
Currently employed part time	16%	18%	-2%
Currently not in school, training, or work	14%	48%	-34%
Average yearly earnings all	\$1748	\$1591	+\$157
Percent with annual earnings > 0	56%	28%	+28%
<b>CHILD-BEARING</b>			
Average children ever parented	.54	.75	-.21
Percent with child ever parented	39%	41%	-2%
<b>DEPENDENCY</b>			
Self receiving food stamps	22%	43%	-21%
Self receiving welfare	20%	42%	-22%

Table 10 continues

	QOP Participants	Control Group	Difference
<b>CRIMINALITY</b>			
Percent ever arrested	19%	23%	-4%
Average number arrests in all	.28	.56	-.28
Percent males ever arrested	27%	39%	-12%
Average number arrests (males)	.46	1.05	-.59
Percent ever incarcerated	13%	21%	-8%
Average number incarcerations all	.21	.49	-.28
Percent males ever incarcerated	23%	50%	-27%
Average males ever incarcerated	.38	.94	-.56
<b>GRADUATED HIGH SCHOOL OR GED</b>			
	68%	42%	+26%
Enrolled in 4-year college:	32%	17%	+15%
Enrolled in 2-year college:	28%	4%	+24%
Enrolled in job-training:	8%	8%	0%
Still in high school or GED:	12%	4%	+8%
Employed, out of school:	0%	0%	0%
Not in school or working:	24%	62%	-38%
Plans to complete 4-year college:	56%	17%	+39%
Plans to complete 2-year college:	28%	13%	+15%
Plans to complete job training:	12%	54%	+42%
No plans for college or training:	4%	16%	-12%

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Source: Taggart (1995).

Table 11

Estimated Impacts of New Chance  
LEAP, and TPD  
(Percentage, and TPD)

Program	Ever Received H.S. Diploma or GED	Ever Received H.S. Diploma	Ever Employed in Previous Year	Avg. Monthly Earnings in Previous Year
<b>New Chance</b>	8.1***	-3.5***	2.8	-3
<b>LEAP</b>				
Not Enrolled	-3.4	-1.1	4.6*	8
Enrolled	7.0*	1.4	-2.6	-18
<b>TPD</b>				
Camden	2.0	4.4*		
Newark	-2.0	-5.2**		
Chicago	3.2	0.7		
<b>Full Sample</b>			-2.0	-18
Dropouts			-4.6	-56
Students			6.3**	79**
Graduates			-8.5**	-84**

Notes:

The follow-up periods for outcomes are approximately 42 months for New Chance, 36 months for LEAP, and 78 months for TPD.

Statistical significance levels are indicated as: \*\*\* = 1%; \*\* = 5%; \* = 10%.

Source: Granger and Cytron (1998)

Table 12

Rates of Return on Investments in Job Training

Data Set	Corrected <i>r</i>	Average Tenure years
PSID, all males	23.5	8
EOPP, young new hires	8.7	3
NLS	16.0	3
NLS (Old NLS)	26.0	4

Source: Mincer (1993)

Table 13

**Experimental Estimates of the Impact of Employment and Training Programs on  
the Earnings of Female  
Welfare Applicants and Recipients**

Services Tested/ Demonstration	Net Cost Per Participant	Annual Earnings Gain (Loss)	
		After 1 Year	After 3 Years
<i>Job Search Assistance:</i>			
Arkansas	140	220**	410**
Louisville (WIN-1)	170	350**	530**
Cook County, IL	190	10	NA
Louisville (WIN-2)	280	560**	NA
<i>Job Search Assistance and Training Services:</i>			
West Virginia	320	20	NA
Virginia	520	90	330*
Employment Services			
San Diego I (EPP/EWEP)	770	600**	NA
San Diego II (SWIM)	1,120	430**	NA
Baltimore	1,160	190	630**
New Jersey	960	720*	
Maine	2,450	140	1,140

Work Experience  
and  
Retraining:

AFDC Homemaker -Health Care	11,550	460**	NA
National Supported Work	16,550	460**	810**

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Notes:

\*\*Statistically significant at the .5 level. N.A. = not applicable

Note: All figures in the table are expressed in 1990 dollars. *Source:* Bell and Reesman (1987), Tables 3 and 4; Couch (1992), Table 1; Gueron, and Pauly (1991), pp. 15-20.

**Table 14**

**Impacts on Total 18-Month Earnings and  
Employment:  
JTPA Assignees and Enrollees, by Target Group**

<i>Impact on:</i>	<i>Adults</i>		<i>Out-of-School Youths</i>	
	<i>Women</i>	<i>Men</i>	<i>Female</i>	<i>Male</i>
<b>Per assignee</b>				
Earnings				
In dollar	\$ 539***	\$ 550	\$ -182	\$ -854**
As a percentage	7.2%	4.5%	-2.9%	-7.9%
Percentage employed	2.1%**	2.8**	2.8	1.5
Sample size (assignees and control group combined)	6,474	4,419	2,300	1,748
<b>Per enrollee</b>				
Earnings				
In \$	\$ 873 <sup>b</sup>	\$ 935 <sup>b</sup>	\$ -295 <sup>b</sup>	\$ -1,355 <sup>b</sup>
As a %	12.2%	6.8%	-4.6%	-11.6%
Percentage employed <sup>a</sup>	3.5 <sup>b</sup>	4.8 <sup>b</sup>	4.5 <sup>b</sup>	2.4 <sup>b</sup>

<sup>a</sup>At any time during the follow-up period.

<sup>b</sup>Tests of statistical significance were not performed for impacts per enrollee.

<sup>\*</sup>Statistically significant at the .10 level;

<sup>\*\*</sup>Statistically at the .05 level;

<sup>\*\*\*</sup>Statistically at the .01 level (two-tailed test).

Source: Bloom, Orr, Cane, Bell, and Doolittle (1993). Enrollee estimates obtained using the procedure in Bloom (1984).



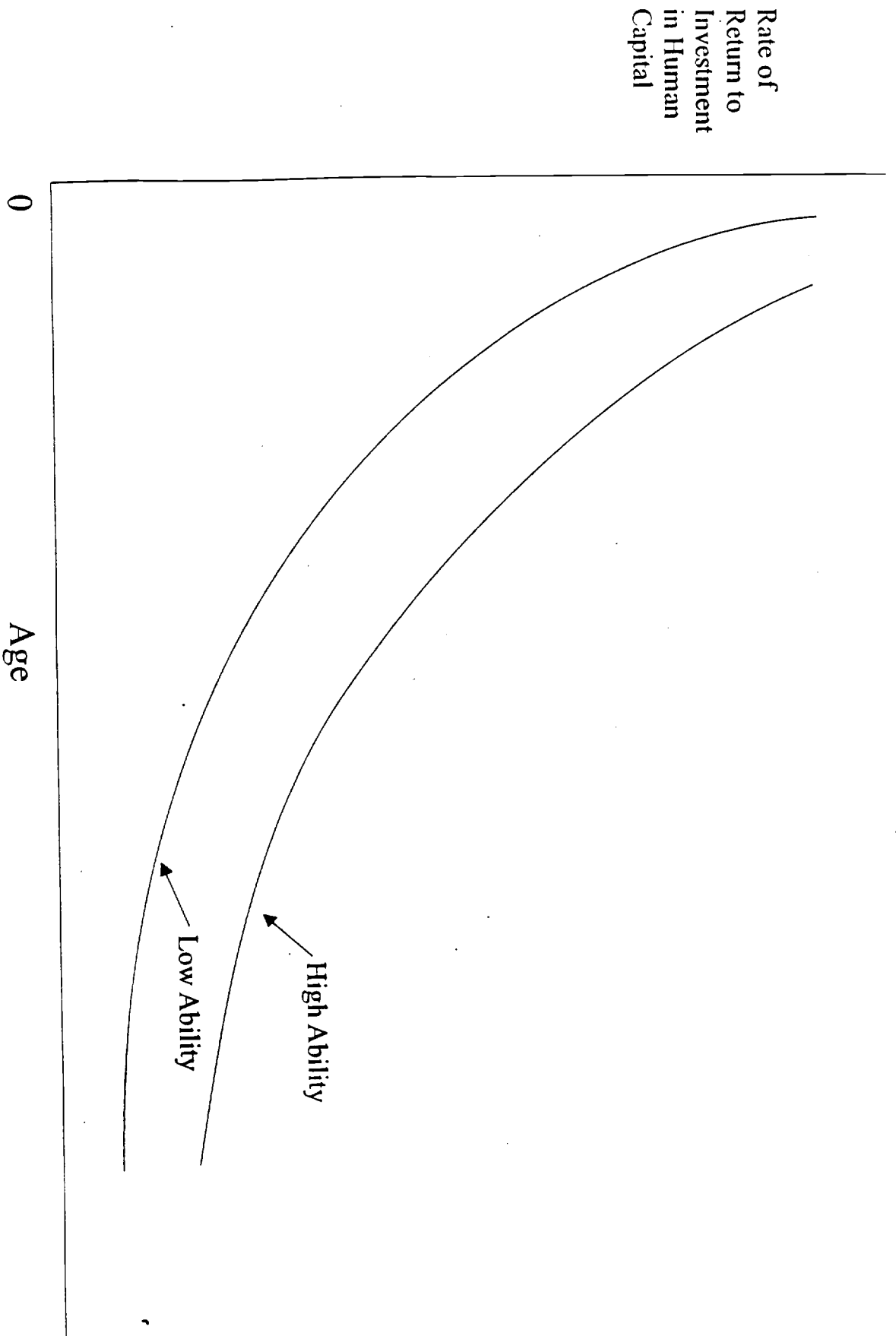
Table 15

**Closed Economy Effects of Alternative Tax Proposals**  
**General Equilibrium (Steady State) and Partial Equilibrium Effects<sup>§</sup>**  
**Percentage Difference from Progressive Case<sup>†</sup>**

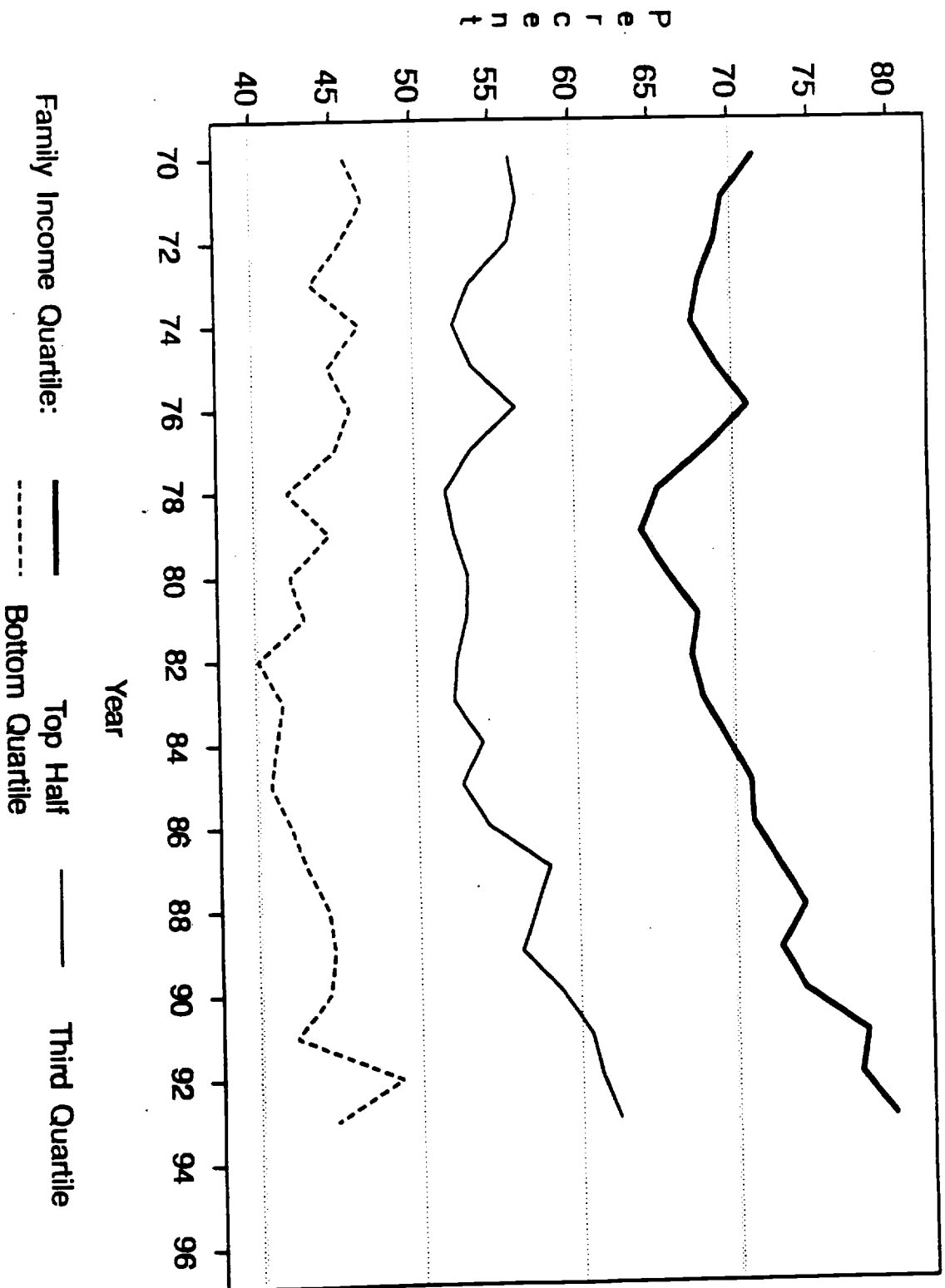
	Flat Tax <sup>†</sup>		Flat Cons. Tax <sup>†</sup>	
	PE	GE	PE	GE
After Tax Interest Rate	0.00	1.96	17.65	3.31
Skill Price College HC	0.00	-1.31	0.00	3.38
Skill Price HS HC	0.00	-0.01	0.00	4.65
Stock of Physical Capital	-15.07	-0.79	86.50	19.55
Stock of College HC	22.41	2.82	-15.77	1.85
Stock of HS HC	-9.94	0.90	1.88	0.08
Stock of College HC per College Graduate	3.04	2.55	-4.08	1.72
Stock of HS HC per HS Graduate	1.84	1.07	-5.23	0.16
Aggregate Output	-0.09	1.15	15.76	4.98
Aggregate Consumption	-0.08	0.16	7.60	3.66
Mean Wage College	3.39	2.60	0.12	6.96
Mean Wage HS	2.44	2.44	0.25	6.82
Standard Deviation Log Wage	4.09	1.56	-1.94	0.69
College/HS Wage Premium at 10 Yrs Exp*	1.92	-0.45	3.10	0.18
Fraction attending college	18.79	0.26	-12.18	-1.92
Type 1: Fraction Attending College	50.29	-1.25	-42.57	2.14
Type 2: Fraction Attending College	28.50	-5.89	-15.60	-7.88
Type 3: Fraction Attending College	14.13	-6.93	-5.20	-9.56
Type 4: Fraction Attending College	15.27	6.13	-11.77	7.50
Type 1: College HC Gain First 10 Years**	5.81	3.12	-7.53	1.51
Type 2: College HC Gain First 10 Years**	5.33	2.86	-6.84	1.38
Type 3: College HC Gain First 10 Years**	5.60	3.10	-6.70	1.61
Type 4: College HC Gain First 10 Years**	6.85	4.17	-6.41	2.56
Type 1: HS HC Gain First 10 Years**	3.42	1.06	-7.79	-0.34
Type 2: HS HC Gain First 10 Years**	4.49	1.97	-7.60	0.46
Type 3: HS HC Gain First 10 Years**	5.36	2.67	-7.62	1.06
Type 4: HS HC Gain First 10 Years**	5.29	2.55	-7.95	0.92

Table continues on next page

Figure 1



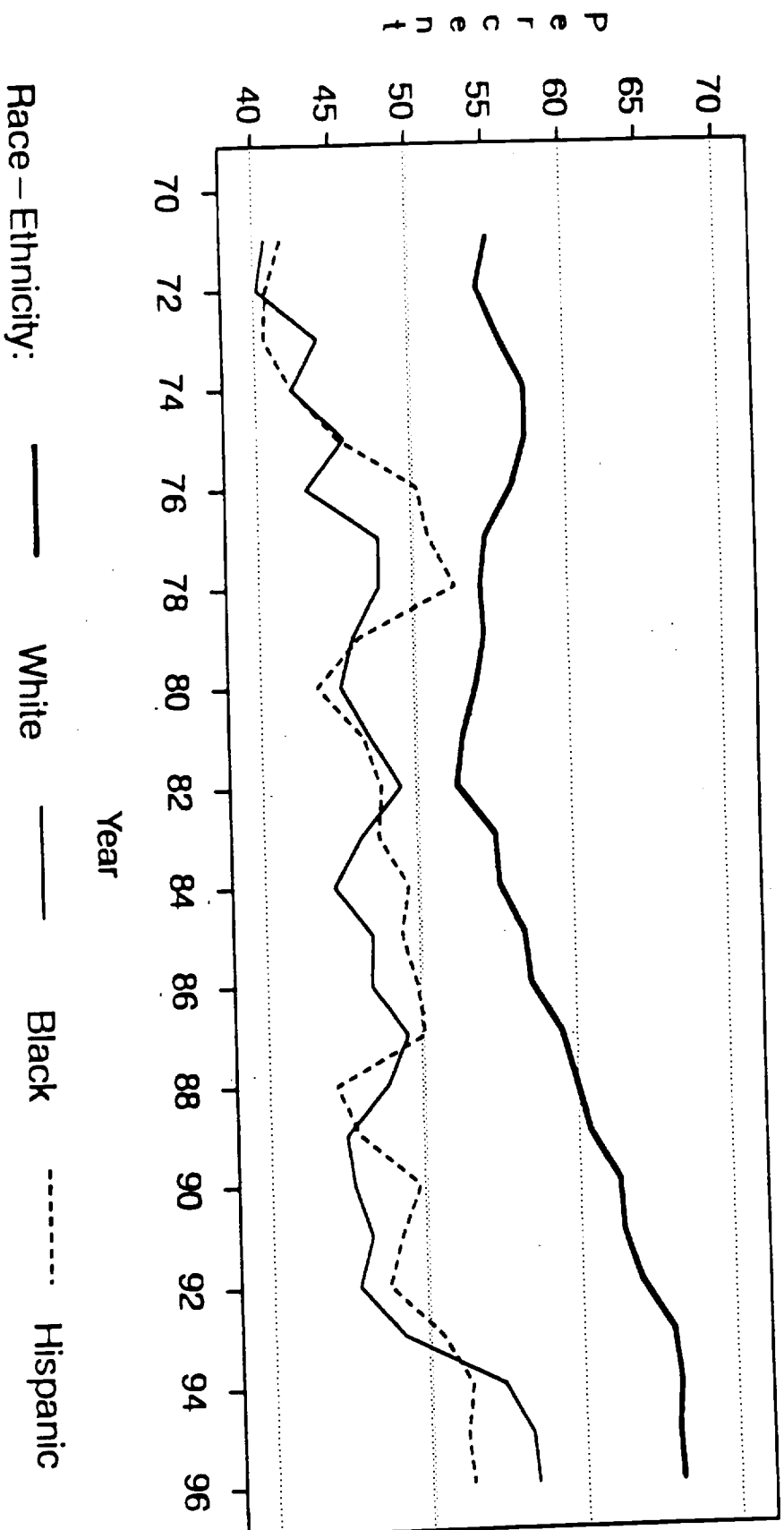
**Figure 2. College Participation by 18 to 24 Year Old High School Graduates and Equivalency Degree Holders**



Note.— These numbers were computed from 1971 to 1989 CPS P-20 School Reports and the 1990-to 1993 October CPS data files. Racial-ethnic categories are mutually exclusive.

Source.—Cameron and Heckman(1998).

**Figure 3. College Entry Proportions of 21 to 24 Year Olds Who Have Graduated High School or Obtained an Equivalency Degree**



**Note.**— The values represent three-year moving averages of March CPS data (two-year averages for 1971 and 1996). Racial-ethnic groups are defined mutually exclusively.  
**Source.**— Cameron and Heckman (1998)

Notes:

§General equilibrium (GE) effects allow skill prices to change, while partial equilibrium (PE) effects hold prices constant.

†In the progressive case we allow for a progressive tax on labor earnings, but assume a flat tax on capital at 15%.

‡In the flat tax regime we hold the tax on capital fixed to the same level as the progressive tax, but the tax on labor income is flat as is calculated to balance the budget in the new GE steady state. This yields a tax rate on labor income of 7.7%. In the consumption regime, we tax only consumption at a 10.0% rate, again balancing the budget in steady states.

\*The college - high school wage premium measures the differences in log mean earnings between college graduates and high school graduates with ten years of experience.

\*\*These rows present changes in the ratio of human capital at ten years of experience versus human capital upon entering the labor force.

Source: Heckman, Lochner and Taber, 1999.