## Exploring Conceptual Frameworks

Attempts to evaluate the impacts of these institutions may consider various types of outputs, but the educational mission has probably generated the greatest returns. Because education is embedded in the individuals who receive it, economists often refer to educational investments as generating human capital (Becker, 1980). Human capital, like other forms of capital, provides a service that pays off over a period of time. And, it is the product of deliberate investment decisions, both public and private. In the next sections, we focus on the role of the 1890s in developing human capital. We discuss how economists conceptualize the link between resources that flow into human capital development and benefits that flow out. We also indicate what might be involved in estimating the net economic benefits from human capital development at the 1890 institutions.

### Human Capital Theory

The concept of human capital has been around for centuries. However, about 40 years ago, the study of human capital increased, in part due to the realization that growth in physical capital explains a relatively small part of income growth in most countries. The search for better explanations of income growth led to improved measures of physical capital as well as to interest in technological change and in human capital and its measurement (Becker, 1980).[4]

The incentive for acquiring human capital through a college education is based largely on technological and other changes in the economy. If technology and the economy as a whole were to remain stagnant, incentives for higher education would be minimal. Education increases society's ability to adjust to ramifications of technological and economic change by helping people figure out how to allocate resources better given the new environment (Huffman, 1977; Schultz, 1975; and Welch, 1970). If they allocate better, they are more productive and efficient, and incomes rise. Students expect to capture the value of their productivity gain in the form of higher wages. Of course, education can also help people make better consumption decisions and improve their productivity in home production, child rearing, and other ways that benefit the individual and society (Michael, 1972).

[4]Much of the conceptual work on the value of human capital was contributed to or stimulated by economists T. W. Schultz and Gary Becker (Schultz, 1961, 1971, 1975; Becker, 1962, 1980, among many other papers and books). A large literature of empirical studies has followed (e.g., Hansen, 1963; Hanoch, 1967; Welch, 1973, 1975; Cain, 1976; Huffman, 1977; Psacharopoulos, 1981; McMahon, 1991; Cohn and Hughes, 1994).

**Table 10—Percent of White college-graduate earnings earned by Black, Latino, and Asian-American college graduates**

| Category | 1939 | 1949 | 1959 | 1969 | 1973 | 1979 | 1982 | 1989 |
|---|---|---|---|---|---|---|---|---|
| | | | | *Percent* | | | | |
| Male: | | | | | | | | |
| Black | 59 | 72 | 67 | 68 | 90 | 82 | 81 | 70 |
| Latino | 61 | 66 | 78 | 76 | 97 | 88 | 90 | 83 |
| Asian-American | 73 | 85 | 85 | 110 | -- | 91 | -- | 100 |
| Female: | | | | | | | | |
| Black | 67 | 89 | 71 | 101 | 97 | 95 | 92 | 94 |
| Latino | -- | -- | -- | 99 | 102 | 94 | 97 | 98 |
| Asian-American | -- | -- | -- | 104 | -- | 110 | -- | 106 |

Source: Carnoy, 1995.

**Table 11—Private rates of return to college education**

| Category | 1939 | 1949 | 1959 | 1969 | 1973 | 1979 | 1982 | 1987 |
|---|---|---|---|---|---|---|---|---|
| | | | | *Percent* | | | | |
| White male | 10.9 | 9.1 | 10.4 | 10.8 | 8.6 | 9.5 | 9.8 | 11.0 |
| Black male | 5.7 | 5.8 | 6.1 | 10.2 | 9.8 | 8.6 | 8.5 | 12.7 |
| Latino male | 7.2 | 7.1 | 8.6 | 7.9 | 10.2 | 8.7 | 11.7 | 12.2 |

Source: Carnoy, 1995.

And as an economy grows, the value of human time increases, increasing the value of human capital and stimulating demand for it in many forms.

Demand for less discrimination in access to schooling and higher education may also increase with economic growth. Discrimination in education and in the workplace reduces the returns to education, both for the individual and for society, and retards economic growth. Evidence indicates that returns to schooling during the first half of this century were significantly less for Blacks than for Whites and were also less for Blacks than they are today (Becker, 1980; Welch, 1973; and Carnoy, 1995), although Black male college graduates still earn significantly less than White, Latino, or Asian-American graduates (see table 10).

Similarly, historical discrimination in education and extension service available to Black farmers hindered their productivity. Huffman (1981), using 1964 data from southern States, showed that Black farmers in the U.S. South obtained lower quality and fewer years of schooling than White farmers, and that the extension services provided to Black farmers were fewer and of lower quality than those provided to White farmers. He estimated an econometric model that identified the quantity and quality of Black farmers' education and extension services as the primary source of their lower productivity relative to White farmers. Huffman (1981) concluded that this lower productivity contributed to the exodus of Black farmers from southern agriculture at double the rate of White farmers during the 1950s and 1960s, when agricultural technology was changing rapidly.

Many empirical studies provide estimates of economic rates of return to schooling, including higher education, and some disaggregate those rates by gender and race (e.g., Psacharopoulos, 1994; Constantine, 1995; and Carnoy, 1995). The rates vary over time with the health of the economy and as structural changes increased job access for minorities and women. Estimated rates of return to a college education have averaged from 9 to 15 percent with a dip in the 1970s (Cohn and Hughes, 1994; Carnoy, 1995; and table 10). Rates of return to a college education for the African-American population were lower than those for the White population for several years (see table 10); job discrimination (Becker, 1980) and lower quality of education (Card and Krueger, 1992b) may have led to lower earnings of Black graduates.[5]

The rates of return to non-White male graduates were in the 6-10-percent range just before U.S. entry into World War II, depending on location, compared to 10-12 percent for white males. These lower rates of return prevailed despite lower forgone earnings (income students might have earned had they been working rather than attending college) of Blacks while they attended college. Even at 6-10 percent, however, college was a good investment for Blacks. By the mid-1980s, it appears that racial differences in rates of return to a college education had essentially disappeared (Carnoy, 1995 and table 11). Although earnings after college remained lower for Blacks than for Whites, the costs of attending college remained lower also, especially the forgone earnings.

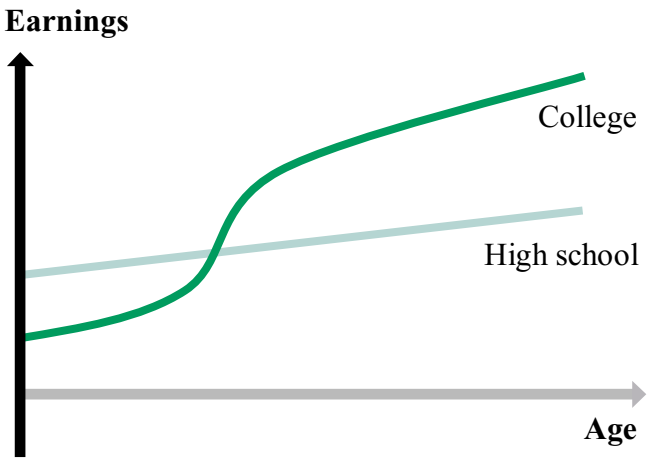
## Measuring the Returns to Human Capital

How rates of return to college education are calculated is relevant for estimating impacts of the 1890 institutions. When economists refer to an expenditure on higher education as an investment in human capital, they are implying it is possible to measure a return on this investment. The return is based on the future income streams generated by the capital, compared to the costs of acquiring it. Cost-benefit techniques can be used to make this comparison, taking into account that costs and benefits occur during different time periods. The typical pattern of earnings for college versus high school graduates is illustrated in figure 4. College graduates receive earnings lower than high school graduates while in college, but receive higher wages when they are older.

Investment in human capital provides net returns to the individual and to society. Individuals benefit from increased lifetime earnings. Earnings after taxes, with and without the education, can be compared with direct and indirect costs of the education borne by the individual. Direct costs include tuition, fees, books, supplies, unusual transportation and lodging costs, and other expenses, while indirect costs include primarily the income forgone while going to school. As indicated in figure 4, even if a student works while in school, his or her earnings are usually less than if he or she were not in school.

[5]Card and Krueger (1992a) found that people educated in States with high-quality schools (as measured by student-teacher ratio, average term length, and the relative pay of teachers) exhibit higher returns to additional years of schooling. In another paper, Card and Krueger (1992b) found that improvements in the quality of education Blacks receive explain 20 percent of the narrowing of the Black-White earnings gap during 1960-80.

Figure 4
**Earnings profiles for college versus high school graduates**




Source: Norton and Tegene (1999).

Society benefits from the increased productivity of the worker. Therefore, society typically bears some of the costs of the investment through subsidized tuition or other means. By accounting for these costs, and by measuring earnings differentials before taxes as well as forgone earnings (before taxes) while in college, an estimate of the social rate of return can be obtained through social cost-benefit analysis. However, some of the benefits to society remain outside this analysis, leaving the estimated returns likely an underestimate of total gains from education.

An alternative way to measure the social rate of return to human capital investments related to education is to estimate a model that relates productivity changes in a country (or to a particular sector such as agriculture) to changes in land, labor, capital, and education.[6] Education might be measured by a variable such as years of schooling. Such models have been estimated both in the United States and in several other countries (see Welch, 1970, for a classic paper related to U.S. agriculture). The difficulty in using this approach for estimating returns to investments in the 1890 universities, however, is that their educational programs have relatively small impacts on the economy or on the agricultural sector (compared to the impacts of higher education as a whole), making their impacts hard to detect empirically.

[6] Likewise, education can be included as a variable in a model that assesses its impact on household productivity or consumption efficiency (see, for example, Michael, 1972).

A human capital approach that focuses on earnings gaps between 1890 graduates and high school graduates is likely to be more fruitful. However, several issues must be addressed in any meaningful attempt to apply such an approach to measuring human capital benefits of the 1890s. First, the models used must be structured to disentangle the effects of inherent ability, other personal characteristics, and job location from the effects of an 1890 education, an issue of concern for any attempt to estimate the value of higher education. A statistical analysis that accounts for the various factors influencing earnings gaps could handle this problem.

A second issue more specific to the 1890s is the need to capture how the returns have changed over time as the degree of discrimination in labor markets has changed. As noted earlier, several studies have found lower returns to education of African-Americans for earlier periods when labor markets were more severely segmented into Black and White than they are today (Becker, 1980; Hanock, 1967; and Welch, 1973), although forgone income while going to college was also low for Blacks in earlier periods. Unless a student prepared for a profession such as medicine or law and subsequently served the African-American community, wage differentials due to a college education were small simply because many jobs that brought returns to greater education were not available to African-Americans, especially in the South. This problem might be handled by measuring only the value of an 1890 education over a more recent period, during which discrimination in the labor market is less pronounced.

A third issue, again more specific to the 1890s, is whether their particular contribution to education is creating a welcoming atmosphere for minority students that encourages students to attend college who otherwise might not. If this contribution is significant, the analyst must decide whether the relevant comparison for measuring the benefits of an 1890 degree is to other colleges attended by Black students, or to benefits of a high school diploma only. Because continued availability of 1890s may be most important for their ability to increase the total number of minority students attending college, the most appropriate comparison may be between an 1890 degree and a high school diploma.

A fourth issue concerns the availability of data sources for estimating a human capital model for the 1890 institutions. Data sets are available that contain information on earnings, level of education, personal char-

acteristics, and other variables needed for estimating the overall value of higher education as a form of human capital. While these data sets are disaggregated by race, they usually do not include the college attended. It may be necessary to survey 1890 graduates in order to complete an empirical evaluation. The issue will then be whether to survey a comparison group or whether to rely on census data to create that group.

This combination of issues has implications for the human capital models and data needed to effectively evaluate the 1890s as human capital "producers." More details of an empirical model that might be used to accomplish this task are presented in appendix A.

## Returns to Research and Extension

While education is the primary activity of the 1890 land-grant universities, these institutions undertake significant research and extension (R&E) activities with potentially measurable impacts. Economic benefits of investments in research and extension are often estimated by using one of two approaches: economic surplus analysis and production function estimation (see for example, Fuglie et al., 1996 and Alston et al., 1998).

Economic surplus analysis incorporates estimated demand and supply elasticities and changes in productivity that can be attributed to R&E to estimate the benefit of research and extension to consumers and producers (consumers' and producers' surplus). To obtain an estimate of rate of return, the changes in consumer and producer benefits are compared to the cost of the research. This approach is most often used for individual innovations or individual commodities for which the productivity change can be easily attributed to specific research funding (Fuglie et al., 1996). The contribution to productivity change of a specific institution or group of institutions is more difficult to identify.

Production function estimation relies on statistical estimation of a production function that contains expenditure on research and/or extension as explanatory variable(s). With this method, productivity growth is related to past investment in R&E and other variables, and an attempt is made to estimate econometrically the part of total output or total factor productivity growth that can be attributed to research and extension. Because R&E at 1890s is a relatively small portion of total agricultural R&E in the United States, it is difficult to estimate a statistical relationship between, for example, agricultural productivity change and funding at these institutions. Of the $6.3 billion expenditure on agricultural research by Federal and State governments and the private sector in 1992 (Fuglie et al., 1996), expenditure on the1890s' R&E was less than 1 percent ($51.1 million) (USDA, 1994).

Given the limitations of the two standard approaches, a better way to estimate economic impacts of R&E at the1890s is to conduct case studies. The case studies would conduct a benefit-cost analysis of a sampling of programs or projects. The sample could either be random or based on a selection of particularly successful programs or projects. Focusing on successful projects often makes sense when it appears that a few projects have impacts so substantial that they more than pay for the funds invested in the entire program. Market data and expert opinion on the effects of projects on yield or costs, adoption of results, and other factors can be used in the benefit-cost analysis. Adequately capturing non-market benefits, such as to the environment and health, can be difficult, particularly for limited-resource farmers, but estimates are possible.