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**THE SOCIAL RATES-OF-RETURN ON HIGHER EDUCATION
IN THE STATE OF TENNESSEE**

By

Roderic Hewlett

**A DISSERTATION PRESENTED TO THE
GRADUATE FACULTY OF MIDDLE TENNESSEE STATE UNIVERSITY
IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR THE DEGREE OF DOCTOR OF ARTS**

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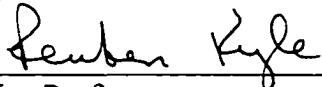
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**The Social Rates-of-Return on Higher Education
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Roderic Hewlett

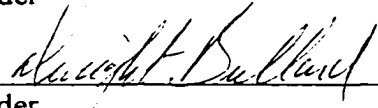
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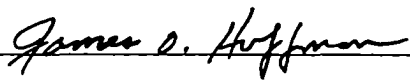
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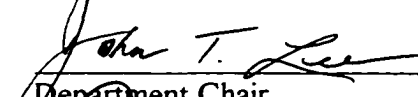
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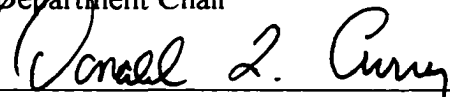
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ABSTRACT

The Social Rates-of-Return on Higher Education in the State of Tennessee

By

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This study extends and adapts the research of earlier studies on human capital and higher education rates-of-return studies to the state of Tennessee. The rates-of-return model is built using age-earning profiles from cross-sectional census data for the state of Tennessee and net public subsidies for higher education by the citizens of Tennessee. The rates-of-return are expressed as internal rates-of-return (IRR), modified internal rates-of-return (MIRR), and net present values (NPV) on a differential basis. The comparison is by gender based on differential earnings for the no-college category contrasted against various levels of attained education categories beyond high school. The benefits to the state of Tennessee for funding higher education are the increased cash flows generated by taxes on the increased earnings and induced earnings associated with higher education. The model concludes with a comparison of the real and nominal rates-of-return on higher education in the state of Tennessee with the expected returns of alternate investments available to citizens of Tennessee.

The study estimates several modules in the development of the rates-of-return on higher education:

1. Net appropriations for higher education.
2. Age-earning profiles for each level of attained education by gender.
3. Workforce entry.

4. Differential earnings between no-college and the various levels of attained higher education.
5. Induced earnings and increased tax collections.
6. Rates-of-return.

The model is based on 1992 graduates from institutions of higher learning in the state of Tennessee.

The main finding of this study is that the social rates-of-return on higher education in the state of Tennessee exceed the expected returns on alternate investments available to the citizens of Tennessee in the same risk class. Public subsidies of higher education in the state of Tennessee by the citizenry represent a very good investment. These findings are consistent with the results reported in other state level rates-of-return on higher education studies.

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CHAPTER I

INTRODUCTION

Investigations of human capital development through publicly funded education and the calculation of rates-of-return on education have been a major research focus of economists, educators, and other social scientists since the 1950s. The concept of investing in the development of humans and the financial returns associated with that investment is critical to the understanding of economic growth.

As with any form of investment, it is essential that the participants in education understand the costs and financial rewards associated with higher education. This awareness provides the participants with information; hence, scarce public resources can be optimized. The participants are the recipients of the education and the taxpayers who fund higher education. Typically, the citizens of a society both partake of and fund education. Accordingly, society invests in its future, and the rates-of-return associated with that investment must be ranked among several potential investments society can make.

A corporation, individual, or any organization faced with investment opportunities must balance present needs against future needs. These investors seek to find a balance by maximizing the present value among investment alternatives. Society, or in the case of

this study, the state of Tennessee, must also engage in this balancing act. Central to the state government's mission is the provision of education.

How much should society invest in education? To answer that question, the state should determine the rates-of-return on its investment in education. In this manner, the state can evaluate among several investment options and arrive at the funding or investment mix that maximizes economic growth and public welfare. As with any investment decision that is long term in nature, understanding past performance and the effects of expectations concerning the future are critical in formulating an estimate of anticipated returns. The same is true for measuring the rates-of-return on higher education.

Purpose of this Study

This study applies human capital theory and financial rates-of-return methodology to determine investment returns on higher education expenditures by the state of Tennessee. Specifically, the rates-of-return for various levels of education are developed. To accomplish this analysis, a general model is developed that connects state higher education expenditures, increased income, and increased tax collections associated with the higher income. This relationship between higher education and higher wages is a reflection of the productivity of education.

This model estimates the amount of state subsidy for higher education, differential earnings associated with various levels of attained education levels in Tennessee, induced income associated with these increased income levels, the increased tax collection

associated with higher income levels, and develops rates-of-return on these enhanced tax collections.

Limitations of the Study

This study is limited by several factors. First, the study uses demographic data collected by various state and federal agencies based on sampling techniques.

Accordingly, some partitioning of the data cannot be accomplished. Specifically, differentiation of age-earning profiles based on school of graduation may be useful but not essential.

Second, historical data are used in estimating future returns. Structural changes, such as modifications to the state of Tennessee's revenue system, can significantly alter the rates-of-return developed in this study. Specifically, a general income tax would have profound effects associated with future tax collections on higher incomes associated with educational attainment.

Third, this model estimates average age-earning profiles associated with levels of educational attainment and should not be applied to specific degree programs, i.e., business degrees versus liberal arts degrees within the state of Tennessee.

Fourth, only education attainment, gender, and worklife expectancy are considered in the development of differential earnings profiles. Other factors that may have some impact on earnings are not considered in this study.

Fifth, the estimated impact tax rate is based on total 1992 state and local taxes divided by only the earnings portion of Tennessee Personal Income (TPI). Interest,

dividends, rent, and transfer payments are assumed to be induced by higher earnings in direct proportion to their current composition of TPI. See Appendix One for the impact tax rate calculation and footnote 14 on page 86 for a sensitivity analysis of rates-of-return to tax rate fluctuations.

Organization of the Study

This study is organized into six chapters. Chapter II includes a review of the literature associated with human capital education investment and rates-of-return on education. The review surveys variables and estimation methods used in past rates-of-return studies. These studies include both general US models and state-specific models.

Chapter III includes the research methodology and a description of the general model used in this study. Chapter III also includes a description of the population, sample, and an analysis of the data used in the study.

Chapter IV presents the findings of this study. An estimation of differential earnings by level of education attainment, induced earnings, enhanced tax collections, and rates-of-returns are presented. A sensitivity analysis associated with differing migration assumptions, and its effects on the real rates-of-return, is presented.

Chapter V presents the educational aspects of this study. The chapter includes a discussion of the implications of this study for educational planners.

Chapter VI presents a general summary, conclusions, and suggestions for future research.

CHAPTER II

REVIEW OF THE LITERATURE

Human capital, and measuring the investment in human capital, has been researched extensively in economic and education literature for the last forty years or so. The theoretical underpinnings of human capital allow empirical tests relating investment in education to economic growth (Bowman 1964, Denison 1962, Psacharopoulos 1981, Schultz 1961) and economic development (Bowman 1980, Carnoy 1977). Additional research has been done on educational investment as it relates to efficiency in consumption and labor productivity (Dean 1984, Welch 1970), household productivity (Haveman and Wolfe 1984), and health (Grossman 1976). Also there have been empirical studies of education and the distribution of income (Chiswick and Mincer 1972, Mincer 1974).

This broad array of research into the relationship between education and economic growth, efficiency, and equity underpins the search for a financial rates-of-return on education. This research calls for an inquiry into the appropriate mix of physical and human capital to fuel future economic growth. The mix of capital is an important concern to educators, policy makers, and industry. The essential ingredients into rates-of-return studies center around a few important topics:

- The relationship between education, earnings, and economic growth.
- Migration patterns of the citizen products of a state's education system.
- Studies of the rates-of-return on higher education.

Section 1: RELATIONSHIP BETWEEN EDUCATION, EARNINGS, AND ECONOMIC GROWTH

Psacharopoulos (1973) argues that as early as Adam Smith, and certainly Marshall, scholars were writing about the economic consequences of education. Modern economists such as Mincer (1958), Schultz (1961), Denison (1962), Becker (1964), and scores of other economists and educators have made significant contributions to the interpretation concerning the relationship between education and human development. Most researchers concentrate on how this form of human development, known as human capital, contributes to economic growth, increased earnings, and other measures of improved welfare.

Psacharopoulos (1973) notes that in the 1950s empirical investigations of the United States economy show total output growing faster than "physical" inputs. This excess of output over input is known as the "residual." The residual is attributed to technical changes or shifts in the aggregate production function. Study of this residual phenomenon leads to an increased attention, by economists, to the labor input in the economy and the study of human capital. Since the 1950s, the study of human capital has developed many variants. The variants that are of particular interest trace the link in

economic growth as a function of formal education. This growth is manifest as increased productivity and enhanced earnings.

Formal education forms the building blocks of human capital in the United States. Formal education is an investment much like the accumulation of physical capital. Viewed as an investment, the process of adding to the stock of knowledge and the process of transmitting this knowledge can be quantified much like the process of adding to the stock of physical capital of the United States. According to Psacharopoulos (1973) the efficiency of this human capital investment can be assessed by:

- Comparing the profitability of human capital investment with the profitability of alternate investments.
- Determining the structure of rates-of-return associated with levels of education.
- Assessing the efficient degree, or level, of public subsidization of human capital investment.
- Determining the earnings ratios of people with different levels of education within a given location.
- Considering the economic consequences associated with higher education graduates who migrate from a political or geographic region to work.

Based on a multi-country study, Psacharopoulos (1973, 1981, 1982) concludes:

- A strong statistical relationship exists that suggests education has both a private and social payoff.

- Returns to investment in human capital are well above returns to physical capital in less-developed countries and are of equal magnitude in advanced countries.
- Per-capita income differences can be better explained by differences in the endowment of human rather than physical capital.
- There is a high degree of substitution in production between types of educated labor.
- Typically higher educated labor is successfully substituted for less educated labor; however, this normally does not work in reverse.

Education and Productivity:

Denison (1967) concludes that educational background is a key determinate in the quality of labor. He states, "It conditions both the types of work an individual is able to do and his efficiency in doing them." Education contributes to productivity on two fronts. Education improves the quality and capability of the workforce, allowing more productive use of the existing stock of knowledge. Increased education tends to increase the rates of intellectual development which add to the existing stock of knowledge (Denison 1962).

Education and Earnings Growth:

Schultz (1961) suggests that the rise in the investment in education accounts for a substantial portion of the rise in earnings. The impact of these increased earnings and

productivity enhancements leads to an increase in national income. This relationship can be thought of as a production function.

A large proportion of the early research into human capital revolves around the amount of earnings growth, or earning differentials, between education levels associated with formal education. This adjustment factor, in the literature associated with the proportion of earning differentials attributed to education alone, is known as the alpha coefficient (α). Research pertaining to the alpha coefficient clearly identifies two major characteristics:

- Formal education is the most significant component of earning differentials.
- Other factors, to be discussed in the next section, may account for some portion of earning differentials.

Denison (1985) uses a methodology in which the alpha coefficient for completed education is estimated at about 0.88. An alpha coefficient of 1.0 suggests that all earning differentials are attributable to completed formal education. Denison's work is an attempt to define an adjustment for growth accounting. Becker (1964) reviews five major studies and finds that the alpha coefficient is 0.80. Becker lays the groundwork for an attempt to estimate the rates-of-return associated with education.

A study by Morgan, David, Cohen, and Brazier (1962) uses 1959 earnings data on 3,000 households and employs the following explanatory variables:

- Education and age.
- Occupation.
- Attitude towards hard work.

- Race.
- Ability to communicate.
- Physical condition.
- Rank and progress in school.

The study finds that education and age are the most significant variables; age and education are undifferentiated in this study. The alpha coefficients associated with a bachelor's and master's degree are 0.88 and 1.00 respectively.

Hunt (1963) uses a 1947 survey by Time magazine on the income of college graduates to create an earnings function. The total number of observations is 2,635. Hunt uses the following explanatory variables:

- Ability (test score in college).
- Years of graduate study.
- Parents college attendance.
- Occupation.
- Region.

Hunt does not identify an alpha coefficient; however, he determines that after adjusting for other factors the rate-of-return to college education is reduced by 50 percent. Critics point to several flaws in this study:

- A high degree of multicollinearity exists because the study uses both occupation and earnings as explanatory variables.
- The study refers to graduates only.
- The study employs a limited sample size.

- The sample technique is based on a survey by Time magazine developed for a news article, not a research project, and may contain sampling flaws.

Carroll and Ihnen (1967) sample eighty-seven high school and two-year post secondary school graduates to study the relationship between education, ability (grades in high school), and other factors found in similar studies. They calculate an alpha coefficient of 0.73; however, they use a very limited sample size and deal only with technical education.

Psacharopoulos (1975) summarizes the alpha coefficient studies and the results are highlighted in the following table:

Table 2.1 -- Alpha Coefficient Studies

Study	Education Level	Alpha Coefficient
Ashenfelter and Mooney (1968)	graduate study	0.90
Weisbrod and Karpoff (1968)	higher education	0.75
Rogers (1969)	higher education	0.73
Griliches (1970)	years of schooling	0.96
Griliches and Mason (1972)	years of schooling after military education	0.88
Hause (1971)	higher education	0.94
Hause (1972)	higher education	0.97
	bachelor's degree	0.87
	graduate study	0.89
Taubman and Wales (1973)	higher education	0.65

Hause's studies concentrate on education and earnings associated with ability alone and use no other contributing factors. Psacharopoulos (1975), reviewing Hause's findings, reveals that when using only ability as a factor associated with formal education the alpha coefficient is 0.97 for higher education and 0.89 for graduate study. When

“other factors” are considered the alpha coefficient for higher education is 0.79 and 0.82 for graduate study.

Compensation, other than earnings, may be an important element to consider in the earnings and education relationship. If individuals with higher levels of education consistently enjoy more fringe benefits (higher compensation levels) than individuals with lower levels of education, then returns developed using only earnings differentials understate the returns to education. Fringe benefits grew from 1.4 percent of total compensation in 1929 to about 10 percent in the 1970s (Psacharopoulos 1975). Psacharopoulos concludes that total compensation should be considered in calculating returns. His analysis demonstrates that in the United Kingdom and United States occupations that tend to be dominated by individuals with higher levels of education also have higher levels of fringe benefits.

Factors Other Than Education That May Affect Earnings:

While it is clear that formal education accounts for the preponderance of higher earnings, some researchers claim that other factors may contribute to earnings other than formal education.

Some economists claim that higher education serves as a filtering, or screening, device (Arrow 1973) for the job market. This concept is also known as the “certification” hypothesis and “signaling” theory. According to this theory, formal schooling does not have a productive role *per-se*. The role of education becomes a mere signaling device for filling higher paying jobs which enables potential employers to select individuals according

to their ability. A substantial component of a worker's ability that is initially unobservable to the employer must be signaled by education. Arrow concludes that since this selection, or signaling, could have taken place by less expensive tests, rather than a four year degree, societal resources are wasted. Economists tend to consider human capital and signaling theories to be the most prominent in attempting to explain labor market returns to education; however, it is extremely difficult to empirically distinguish between these competing theories (Willis 1986). Other related theories, which tend to be related to signaling, have been proffered to explain returns to labor.

Layard and Psacharopoulos (1974) attack this reasoning by observing that there are increased earnings associated with individuals who have "some higher education" but do not have a bachelor's degree. Chiswick (1973) reinforces this human capital approach by suggesting that a self-selection bias exists. He reasons that individuals who drop out before attaining a desired level of education do so because they realize they do not have the ability to effectively employ the additional human capital. Hence, there is little or no "diploma effect" associated with signaling theory; individuals merely recognize their limitations and "drop-out." This theory introduces the role that education plays in informing not only the employer but the prospective employee about ability. While there may be other reasons for individuals not to complete an additional level of education, this argument is effective in explaining the dual role education may play in the "signaling theory."

Psacharopoulos (1973, 1981) points out that labor markets tend to be competitive and earnings tend to reflect the marginal product of labor. Hence, if degrees were merely

signaling devices, then the related higher earnings associated with the degree would quickly dissipate and return to a generalized wage pattern. Psacharopoulos (1975) adds that earnings associated with higher attained education levels tend to be quite persistent demonstrating that the investment in education continues to extract high returns during career spans.

Boissiere, Knight, and Sabot (1985), in a study based on Kenya, find that the screening theory explains why levels of education may bear some relationship to starting wage; however, if education is only a signal that produces an economic rent, one would then expect wages to decline with length of experience to match the employee's marginal product of labor. Yet, this is not the case. The level of education is found to be a better predictor of current wage than starting wage. These market effects are due to skills developed in a highly competitive education environment. Boissiere *et al* argue that literacy and numeracy have the most pronounced effects and that length of education has less affect. This result provides compelling support for the concept of human capital employed in the United States and other developed countries. Education that produces skills which complement advanced technology employed by society tends to garner higher returns. In technologically advanced societies, the attainment of advanced education is integral to the acquisition of these required skills.

The term "ability" takes on many different definitions in the debate on what affects earnings. Some suggest ability is genetic (Griliches and Mason 1972) and that education hones this native ability and serves as a signal. Others insist that ability has more to do with education than some form of genetic endowment, family background, or other

measure of ability (Psacharopoulos 1982). Finding an operational definition of ability is elusive. Psacharopoulos maintains that formal education is so intertwined with ability that it is difficult to separate them into individual concepts. Formal education, which provides literacy, numeracy, critical thinking capabilities, and develops work habits, serves as the basis for all other types of study and development. Accordingly, earnings growth and advancement are directly related to the level of formal education attained. In an attempt to isolate education and other factors and their relationship to productivity and earnings, Jamison and Lau (1982) study self-employed and agricultural workers. Jamison and Lau find a very strong relationship between productivity and formal education.

Mincer (1962) claims that on-the-job training (OJT) accounts for approximately one-half of the returns to certain levels of education. However, using Psacharopoulos's definition of ability, it is apparent that Mincer does not fully consider the impact that formal educational attainment exerts on employees' abilities to successfully undertake OJT. Becker (1964) hints at this symbiotic relationship when he makes his distinction between general and specific training. He notes that second-round interaction between formal education and the trainability of the employee, brings to the surface the "unrecorded benefits" (associated with formal education) later reaped by the firm that invests in specific employee training. Becker (1964) concludes that ability explains a very small part of the earning differentials and college education explains the larger part.

Education, and its ancillary or non-market effects on earnings, is rarely considered or calculated as a return on education. Cochrane (1980) reports significant partial effects of literacy on life expectancy after standardizing for the level of income. Hicks (1980)

reports positive deviations from normal life expectancy associated with higher rates of per capital GNP growth.

Jorgenson and Fraumeni (1993) redefine social accounting to include non-market benefits of education and human capital investment. They measure the economic value of labor market activities then estimate the value of non-market labor activities. When these new measures of economic activity are calculated the returns to education skyrocket. Many of the benefits suggested by Jorgenson and Fraumeni include increased value of leisure time, enhanced parenting, increased health and environmental medicine (decreased morbidity and mortality), increased consumption, and labor saving devices that reduce household type work.

Gordon (1972) proposes a labor market segmentation or duality hypothesis. This hypothesis suggests that two distinct labor markets exist: one for high skill employees and one for low skill employees. Market conditions, rather than education, account for earnings. However, when a distinction is made between non-clearing and competitive labor markets, Cain (1976) finds that wage differentials in the public sector understate the true productive advantage of the more educated as the latter is measured by earning differentials in the competitive private sector (Psacharopoulos 1982).

Hybrid theories that combine historical blockages of individuals to institutions of higher learning with signaling theory suggest that social class may account for the earning differentials. However, in a review of several studies and in empirical work Psacharopoulos and Tinbergen (1978) conclude that social class is not the main determinant of earnings net of education.

Psacharopoulos (1975) evaluates the extent to which market distortions, rather than education, account for wage differentials. An example is the limited supply of medical doctors and a high level of demand for medical services. Psacharopoulos reviews a wide range of studies and finds the results inconclusive. However, several factors relating to this professional type of labor must be considered:

- The high costs of training associated with professional education.
- Longer hours worked by those with higher incomes.
- The lifetime aspect rather than a cross-sectional comparison at a given age (forgone wages and high investment costs).

Psacharopoulos concludes that if a profession requires extensive education that is essential to quality and productivity no market distortion exists; however, if excessive training for the sake of market entry barriers exist then distortions exist.

Age-Earning Profiles and Rate-of-Return Methods:

Many early studies concentrate on developing the earning profiles over one, or a few, individuals during the span of their lifetime. Some of the subsequent studies use limited cross-sectional and longitudinal data (Psacharopoulos 1975). A limiting factor with any study that uses current or historical data is the ability of these profiles to reflect future age-earning profiles.

Psacharopoulos (1975) argues that age-earnings profiles developed with longitudinal data are contaminated by the experience dimension and therefore are limited for formal educational policy but not for developing rates-of-return analysis.¹

A simple model for determining an age-earning profile is put forth by Jacob Mincer (1958). The model considers the average length of working life in occupational groups.² In Mincer's simplified model he uses zero expenses for educational services and concentrates on earnings associated with attained education levels (years of training). Additionally, he discounts earnings to arrive at a present value of life-earnings at the start of training. His reasoning is based on the premise that economic decisions are based on rational choice. In making the decision to pursue further education, a rational individual weighs the benefits against the costs and determines if it is prudent to pursue further education. Hence, Mincer discounts earnings to present value (PV). Mincer's early work still permeates age-earnings profile research today. His model creates a ratio of annual earnings by individuals with different attained education levels. The difference between attained education, d , is the basis for the model:

¹ Since Psacharopoulos's research indicates that education forms the basis for employing other labor productivity enhancements, the associated returns should accrue to attained education.

² Mincer based his findings on the information used by Friedman and Kuznets in Income from Independent Professional Practice. New York: National Bureau of Economic Research (1945): 142-151. Eight broad categories were used ranging from service workers up to professional and technical workers. Those occupations that provided lower retirement enhancements and required less preparatory education had longer mean years in the labor force (52) as opposed to professional workers which had the lowest number of years in the labor force (40). Mincer noted that similar patterns were observed in 1930, 1940, and 1950.

$$k_{d,0} = \frac{e^n - 1}{e^{r(t-d)} - 1}$$

where:

- e is the base of natural logarithms.
- t is time in number of years.
- k represents the ratio, considered a multiplicative factor, of earning differentials between attained education levels.

Subsequently, Mincer adds the PV of schooling costs and foregone earnings to the simple model.

Mincer's model is now a widely accepted standard. Age-earning profiles demonstrate that more education equates to more earnings.³ When graphed with *income* on the vertical axis and *age* on the horizontal axis a graphical age-earning profile is established. Universally, the graphs show earnings increase rapidly during the first ten to twenty years, then peak in the 45-55 age bracket, then decline to age 65. Characteristically, those profiles of higher attained education reflect higher income levels than the profiles of lower levels of attained education. These profiles are merely graphical representations of earning differentials. Mincer suggests that formal education levels, OJT, and experience affect the profile slopes. The declining slopes at the end of the profile reflect depreciation of human capital or a deterioration in productive skills, particularly in jobs that require physical or motor skills. Of significant importance, Mincer

³ Based on data found in the US Census of Population (1950), Ser. P-E., No. 5-b: Education, Tables 12 and 13.

(1958) notes that using cross-sectional data eliminates much of the distortion of age-earning profiles due to seasonal or cyclic forces.

Mincer separates education into two classifications: formal or time preparing for the job; and informal or education (OJT and employer provided training) plus experience.⁴ Mincer's early work with age-earning profiles uncovers patterns that not only exist today but have become more pronounced. Industries that tend to require higher levels of attained education, make use of advanced technology, and require innovation tend to make up a significant proportion of top earning jobs: professional and business services, entertainment and recreation, and finance and insurance. Industries requiring lower levels of attained education reflect a lower proportion of top earning jobs: mining, construction, and manufacturing.⁵

Becker (1964) concludes that increased investment in education is induced by technological progress based on a high rate-of-return as measured by the costs of education and the wage differences associated with higher attained education. Becker also notes that almost all studies show that age-earning profiles tend to be steeper among more educated persons; therefore, an investment in human capital makes the profiles more concave. Hence, education tends to steepen the age-earning profiles. Becker's techniques are similar to Mincer's; however, Becker's age-earning profiles do not decline for the age groups at the end of their working lives. The slopes of the profiles moderate, or flatten,

⁴ Mincer notes that Census data available in 1958 and prior periods does not adequately exist to separate the effects of formal and informal education.

⁵ Table 4, page 300. Mincer (1958) "Occupational Composition and Income Inequality in Industries. US Male Workers. Ten Broad Industry Groups, 1949, 1953, 1954.

but do not decrease.⁶ The slopes in Becker's age-earning profiles are of particular interest; the slopes for cohorts with higher levels of attained education are steeper and earnings growth for lower education levels occur at an earlier age. A significant difference between Mincer's and Becker's profiles is the netting out of the investment costs prior to the calculation of the age-earnings profiles. All earnings are after-tax. While Becker agrees that OJT, migration, and adult education can contribute to the steepness of the age-earning profiles, he notes that these factors tend to be positively related to education. Becker suggests that a simple theory of investment in human capital explains the difference in concavity as well as in steepness in the age-earning profiles.

Psacharopoulos (1981) distinguishes between three main methods to calculate age-earning profiles, and hence rates-of-return, associated with investment in higher education. The three methods include the Elaborate Method, the Earnings Function Method, and the Short Cut Method.

The Elaborate Method equates a stream of benefits to a stream of costs at a given point. This method is generally equivalent to developing an internal rate-of-return (IRR) for costs associated with education and the associated benefits. The benefits are generally differential earnings developed by the age-earning profile. This method is particularly useful in calculating a private rate-of-return for the individual or a social rate-of-return. The social rate-of-return uses the cost of subsidizing education measured against a stream

⁶ Becker based his findings on 1950 census data. He suggests that a plausible reason for Mincer's finding that earnings decline prior to the end of working life (age 55-65) may be due to selective retirement before the age of 65. Becker reasons that persons whose earnings would decline most might elect to retire early.

of benefits to society which are typically derived from the age-earning profile.⁷ The age-earning profile, the basis for the benefits, tends to exhibit a characteristic saw-tooth pattern, which creates a highly sensitive rate-of-return calculation.

To smooth-out this calculation, three steps are typically followed:

- A regression is fitted within subgroups of workers with the same educational level for the purpose of summarizing the data.

$$Y_i = \alpha + \beta_1 AGE_i + \beta_2 AGE_i^2$$

- An idealized age-earning profile is developed by predicting the value of Y for given ages and educational levels, using the estimated function (above).
- Determine the IRR

The Earnings Function Method is typically used for calculating private rates-of-return and typically takes the form:

$$\ln Y_i = \alpha + \beta_1 S_i + \beta_2 EX_i + \beta_3 EX_i^2$$

where:

- S = years of schooling for the individual.
- EX = years of labor market experience.

⁷ An example of a benefit to society could be the increased incremental tax revenue derived from higher earnings, lower unemployment, and other measures of increased welfare.

The Short Cut Method is an abbreviated method to use with data that is already tabulated by earning and education level. It is useful in developing a quick calculation of private rates-of-return.

The methodology debate concerning age-earning profiles and rates-of-return studies tends to focus on three distinct issues (Blaug 1976):

- Does a bias exist in reduced form earnings functions (identification problems)?
- Which variables are the most appropriate for estimating rates-of-return (proxy variables)?
- Does the School Model of human capital put forth by Schultz, Becker, and Mincer apply?

The methodology debate is an attempt to clarify education policy implications. Definitions of the proxy variables, such as ability, social affiliation, or OJT, are elusive. The variables interact to enhance earnings, but attained education remains the catalyst (Griliches and Mason 1972; Psacharopoulos 1973, 1981). Mincer (1974) discusses the difficulty of attempting to isolate years of experience from the quality of experience (development of human capital). In an overwhelming proportion of research attained education is the major factor that relates wage growth and facilitates human capital development.

Supply and demand market conditions for educated labor also accounts for the rates-of-return associated with education. A recent Australian study finds that supply and demand characteristics for each category of education tend to be dominant factors in earning differentials (Borland 1996).

The factor markets in developed countries demonstrate the requirement for additional formal education in the work force. Market recognition is highlighted by the fact that the percentage of jobs requiring only high school education is declining, while the percentage of jobs requiring a college degree is increasing.⁸ Additionally, the slopes of the age-earning profiles for high school graduates continues to flatten (Hanushek 1996). This shallow profile demonstrates reduced earnings of high school graduates at each median age calculation. Market requirements tend to exacerbate this divergence of wages between different levels of attained education.

The shapes of the age-earning profiles are sensitive to market conditions and requirements for an educated workforce adept at implementing advanced technology. The growing earning gap between United States college and high school graduates demonstrates this sensitivity (Levy 1995). Levy finds that human capital is becoming an increasingly important determinant of earnings. The supply characteristics between high school graduates and college graduates are significantly different. Among men ages 25 to 54, 27 percent have four years of college or more, while 48 percent have a high school diploma or less. Earnings for college graduates are still growing in real terms; however, the real wages for high school graduates are falling.

The demand for educated labor, and the prevailing earnings increment associated with attained levels of education, is a derived demand dependent on the level of technology and advanced systems used by employers (Borland 1996). Accordingly, the rates-of-return associated with higher education should be higher in technologically

⁸ 1979 and 1989 earnings figures calculated using the 1980 and 1990 Public Use Micro Sample (PUMS) 1 percent sample.

advanced countries. Naturally, the rates-of-return are also affected by the supply of graduates with high levels of attained education and the elasticity of substitution among educated workers (Borland 1996).

A criticism that is occasionally leveled at rates-of-return studies concerns data usage or the limitation of data. Specifically, a major complaint is the use of cross-sectional data. Recent studies have attempted to find methods of developing longitudinal data sufficient for estimating age-earning profiles and rates-of-return. While the studies have severe limitations in their methodology (specifically shifting demographics) one study provides a particularly interesting method of emulating a longitudinal estimate (Arias and McMahon 1996). The authors contend that cross-sectional data do not pick up the variation in employment profiles associated with shifting technologies and the subsequent supply and demand changes. Additionally, they claim that these shifts have differential impact on different age-earning profiles. The method of adjusting the cross-sectional data is referred to as “dynamic rates-of-return” and uses a series of cross-sectional data to adjust the age-earning profiles.⁹ The authors conclude that conventional static rates-of-return tend to overstate actual returns when the net earning trend is downward and understate it when the trend of the net earnings differential is upward. They also note that dynamic profiles are smoother over time than conventional profiles. These data are national level data and may be inappropriate for some forms of estimating; however, they do provide a sensitivity analysis of returns to changing socio-economic conditions. When

⁹ By using the Current Population Reports, Series P-60, collected through personal interviews by the Bureau of the Census approximately 60,000 households are evaluated each March from 1967 through 1975 (1967-1975, 1980, 1985, and 1990).

computing conventional and dynamic rates-of-return from 1980 through the mid 1990s, the dynamic returns for males and females are 4 percent and 5 percent higher than conventional cross-sectional rates.

Section 2: MIGRATION

Labor migration has been a significant research topic among social scientists since the 1960s. The literature tends to fall into two broad categories: the determinants of migration and the consequences of migration. Earlier research typically focuses on the causes of migration. As the United States becomes a more mobile society the research has increasingly addressed the consequences associated with migration.

Determinants of Migration:

Economists tend to view migration as a function of rational individual choice and utility maximization. If there is a net economic advantage to be gained, mainly due to increased earnings, then labor will tend to migrate from one geographical location to another (Hicks 1932). A variety of studies are directed at testing Hick's propositions. These studies look at both gross migration and net migration. Gross migration consists of a single flow of labor from one location to another. Net migration is the net difference between the flows from and to a geographical location (Greenwood 1975).

Gross migration studies tend to adopt a gravity type migration model (Greenwood 1975). These studies hypothesize that migration is directly related to the size of the origin and destination population (i.e., rural to urban migration) and inversely related to distance

(Carrothers 1956, Isard 1960, Olsson, 1965). The behavioral basis for reduced levels of migration as distance increases has been attributed to distance serving as a proxy for both the transportation and psychic cost of movement.

Lansing and Mueller (1967) conclude that the direct costs of moving in most cases is a very nominal sum of money. They suggest that the three major factors associated with the importance of distance as a factor in migration include:

- The benefits associated with migration may in fact be small; hence, a small cost may discourage migration.
- The psychic costs involved in migration are substantial and closely related to distance.

Economic theory suggests that an individual will maximize the net present value (NPV) of benefits and costs associated with any decision. In the migration decision, income is important in the decision process (Greenwood 1975). The relevant income is critical in the calculation of the present value of expected future benefits associated with net returns. Sjaastad (1962), building on the human capital models of Becker, Schultz, and Mincer, connects the decision to migrate to the human capital model where current wages serve as a proxy for the future stream of net returns. Sjaastad believes that income is the major determinant in the decision to migrate. In a similar study, Perloff (1960) finds that income and job opportunities provide a better explanation of immigration than they do of out-migration.

Galloway (1969) reports that migration tends to occur at the end of a period of investment in human capital. This typically happens at the completion of college or study

for an advanced degree. Accordingly, much of the return associated with migration may actually be due to the investment in human capital. Lansing and Mueller (1967) conclude that unemployment serves as a motivation that encourages young well-educated and trained individuals to migrate, especially if they tend to live in small towns.

Becker (1964) finds that both level of education and age tend to have an effect on the decision to migrate. As age increases, the worker has a shorter work life remaining and a reduced net positive benefit from migration. Becker also finds that employment information and job opportunities increase with additional attained education. Galloway (1969) argues that as an individual ages security and family ties increasingly reduce the likelihood that an individual will migrate. Wertheimer (1970) concludes that greater returns are associated with migration at an early age and education tends to reduce the importance of tradition and family ties. In the past, ethnic patterns of migration tended to be different from general patterns of migration (Rebhun 1997). However, Rebhun now reports that ethnicity is a relatively unimportant indicator of migration while attained education and economic opportunity are better indicators of migration.

Additionally, education increases awareness of opportunities in other locations. This awareness weakens the tendency for individuals to remain at their present location. Schwartz (1973), controlling for age, finds that education ameliorates the effects of distance on migration. Schwartz reasons that labor markets for the better-educated are more national than the markets for less-educated. The correlation between education and migration increases as the distance of migration increases (Suval and Hamilton 1965). O'Neill (1970) modifies Hamilton's proposition by stating that this correlation applies to

the college-educated only. In a study attempting to determine the causes of migration from Canada to the United States, the dominant factor is an attained higher education degree from the United States (Comay 1971). Comay finds that attaining a United States degree breaks down the barriers associated with “psychic” costs as well as provides access to an enhanced labor market. Frey (1994) reports that the best educated are more in-tune to labor market shifts and are the best able to exploit these shifts. Frey also reports that age and attained education continue to be a driving force in migration.

In conclusion, the determinates of migration tend to revolve around a few well accepted propositions:

- Migration tends to occur from low to high income areas.
- Age and education are personal characteristics that are important in influencing migration.
- The younger and the more educated the individual the greater the probability an individual will migrate.

Consequences of Migration:

The literature tends to be concerned with two effects of migration: market efficiency and externalities associated with migration (Greenwood 1975). Sjaastad (1961) notes that gross migration reflects the degree that the labor force is being reshaped by changing supply and demand conditions among industries. Becker (1964) notes that in competitive firms workers are paid wages equal to the marginal product of labor. If firms invest in workers, through training and experience, they may pay the workers a wage in

excess of the marginal product of labor in an attempt to retain these employees.

Greenwood (1975) concludes that inter-regional wage differentials dissipate over time with migration and suggests that the degree of efficiency depends on externalities associated with migration.

Greenwood points out that labor is not homogeneous and migration is selective. Migration tends to be the highest among the best-educated. The application of the human capital theory to the analysis of “brain drain” exemplifies the externalities associated with migration. Romans (1974) illustrates this externality with the assertion that there are spillover costs associated with social investment in education (social returns) that are lost to a geographic area if recipients later migrate. Johnson (1965) notes the region that loses people educated with tax subsidies also lose the ability to recoup the investment by taxing the higher income associated with the education. Weisbrod (1964) offers a complementary argument: migration of the better-educated, better-paid (hence higher taxed) people, in or out of an area, has a significant effect on the tax burden and government services of the less-educated people. Haque and Kim (1995) conclude that closed economies, or economies not prone to high levels of migration, should subsidize all levels of education; however, areas suffering “brain-drain” due to high levels of migration should only subsidize lower levels of education. Haque and Kim specifically evaluate international migration; however, this point is not lost on state legislatures. Strathman (1994) calculates that for every one percent increase in out-migration state appropriations for higher education are reduced by \$100 per student.

Schwartz (1971) agrees that there are externalities associated with migration but concludes that migration may be a measure of economic (labor) efficiency. Schwartz suggests that low ratios of net to gross migration reflect an efficient past and present migration which reflect higher regional equality. The relationship between net to gross migration and education level would be expected to be inverse (i.e., as education level increases the ratio of net to gross migration decreases). Schwartz concludes that the level of information is an increasing function of the level of education.

In summary, migration can be both an indication of the efficiency of the regional and national economy; however, migration may cause externalities for local or state economies. These externalities usually take the form of lost future tax revenues which reduces the returns on the education subsidies provided by the local or state government.

Section 3: HIGHER EDUCATION RATES-OF-RETURN STUDIES

There are numerous studies concerning rates-of-return associated with education. Mincer (1958, 1974), Becker (1964), and Schultz (1961) set the methodology parameters. In these ground breaking human capital studies significant positive private and social rates-of-returns are calculated. Psacharopoulos (1973, 1981) evaluates rates-of-returns, for all levels of education, associated with developed and developing countries. He finds positive rates-of-return for all levels of education; however, rates vary by level of education depending on whether the country is developed or developing.

There are a myriad of rates-of-return studies by researchers and various government agencies. Many of these studies are associated with private rates-of-return or

degree specific rates-of-return and are generally unrelated to social rates-of-return for state-funded education. The studies of keen interest to this dissertation are social rates-of-return studies developed at the state level.

Oklahoma Study:

Penn and Dauffenbach (1995) develop rates-of-return associated with higher education in the state of Oklahoma. Specifically, they seek to determine the economic efficacy of public recoument of state subsidies for higher education. Using data from the Bureau of the Census¹⁰ they develop age-earning profiles using the Elaborate Method to smooth the profiles. Profiles are constructed for both males and females subdivided by level of attained education: no college, some college, associate's degree, bachelor's degree, and graduate degree (including professional degrees).

“Net appropriations” are calculated for 1992-1993 school year.¹¹ These net appropriations are the social costs of education for the state of Oklahoma and form the basis to calculate the IRR of the education investment. Graduation, dropout, continuation, and migration are considered in developing workforce entry calculations. The lifetime age-earning profile, adjusted to consider workforce entry, forms the basis for determining incremental earnings by gender and by attained levels of education. The

¹⁰ Public Use Micro Sample (PUMS) developed by the Bureau of the Census from the Census of Population 1990.

¹¹ Total appropriations are adjusted for state sales and income taxes generated by the operations of the colleges and universities.

additional taxes associated with the higher incremental earnings over the worklives of the workforce entrants are the benefits or “returns” to the state.

The study concludes that the minimum social rate-of-return expected is 8.0 percent; however, the return may be as high as 10 percent if an alternate moderate out-migration pattern emerges. Compared with returns on alternate forms of investment for the state, the authors conclude that additional investment in higher education is a very good investment.

Alabama Study:

This study is an assessment of the economic impacts of the University of Alabama (Gunther 1997). Economic investment is developed in a human capital approach where the rates-of-return are developed as present values of earning differentials net of costs and expressed as an IRR. Gunther considers two types of economic impacts: differential earnings based on attained education and the fiscal impact due to enhanced taxation of the differential earnings.

Differential earnings are based on differential starting salaries for the attained level of education: high school, some college, bachelor’s, master’s, and doctorate for the graduating class of 1995.¹² The earnings are projected for the working life of the graduates based on assumed real growth rates.¹³ The starting salary differentials by

¹² Data obtained from The University of Alabama’s various placement offices and some national estimates.

¹³ High school 0.42 percent; some college 0.84 percent; bachelor’s 1.17 percent; master’s 1.16 percent and doctorate 1.16 percent based on estimates by the Center for Business and Economic Research, The University of Alabama.

attained education are extended over the worklife by differential growth rates expressed as age-earning profiles. The private rates-of-return range from more than 10 percent for a master's degree to over 21 percent for some college and a bachelor's degree. Using a net appropriations and tax differential approach, the real social rate-of-return is 4.3 percent for all levels of attained education from the University of Alabama. Gunther estimates that if inflation runs 3.0 percent then the nominal rate-of-return is 7.3 percent.

Gunther concludes by noting that a 7.3 percent social rate-of-return exceeds the 30 year US Government Bond rate current at the time of the study. Gunther suggests that both the private and social rates-of-return provide benefits that exceed most alternate forms of social and private investment.

Kansas Study:

Burress and Orlund (1996), in an ambitious project, attempt to build a counterpart to the rate-of-return on education -- the Return on Public Investment Model (ROPI). Specifically, Burress and Orlund use the profitability index model,¹⁴ similar to the Elaboration Method, to assess the marginal costs and benefits of technology transfers on a present value basis.¹⁵

¹⁴ The present value of benefits divided by the present value of costs. A value of one indicates that benefits equal costs, a value in excess of one indicates that the present value of benefits exceed the present value of costs. If public funds are unlimited then a value of one or higher would indicate that the program should be implemented or continued. A serious limitation of this method is that it provides a comparative index; however, the magnitude of the investment or return is not clearly evident.

¹⁵ The model was developed and applied to the Kansas Technology Enterprise Corporation. It evaluates the effectiveness of public monies used to implement technology transfers to recruit and develop technologically advanced companies in Kansas.

The success of the estimation of the rates-of-return on education encouraged this companion calculation. The benefit to rates-of-return studies is that it provides a metric, or benchmark, to be used for evaluating the effectiveness of competing public programs. As with education rates-of-return the evaluation is based on performance outcomes rather than process outcomes.

University of Virginia Study:

The University of Virginia economic impact study (Knapp 1991), while not specifically developing a social rate-of-return on education, offers insight into economic modeling that helps expand upon some of the methodology used in assessing local impacts associated with institutions of higher learning. The methodological tools employed in the study, rather than the results, are of prime interest.

The study, titled “Warts and All,” estimates both the positive and negative impacts of the university on the community. Of particular interest is the inclusion of the costs of additional police, fire protection, and solid waste disposal costs not fully covered by the university’s fees and forgone tax revenues.

In estimating the impact associated with the externalities the analysis draws heavily on the Regional Input-Output Modeling System (RIMS II).¹⁶ This methodology allows for a concise estimate of impacts of subgroup spending patterns (i.e., faculty and staff) on

¹⁶ Developed by the US Department of Commerce, Bureau of Economic Analysis. This model is based on national input-output coefficients, which offer a non-survey technique for determining how changes in final demand by a sector will impact the economy.

the local economy relative to income and job expansion. This even-handed approach improves both the overall effectiveness and efficiency of the economic impact analysis.

Texas Study:

The Texas study is a comprehensive review of economic growth with respect to investment in higher education (Devereux et al 1987). The study boldly states, “Investment in a strong and dynamic system of higher education contributes significantly to growth and development and minimizes the impact of national recessions.”¹⁷ The goal of the study is to demonstrate that education investment translates directly and indirectly into increased state income and increased state revenue, which creates a positive economic growth cycle.

The authors note that increases in a skilled labor force expand job opportunities for both skilled and unskilled labor; hence, there is a “trickle-down” effect from higher levels of attained education on the lower levels of attained education that is typically not captured in social rates-of-return studies.

Higher education is unique since it combines technical training with a liberal arts education. The interaction of technical, communication, and critical thinking skills produces workers capable of efficiencies in a technically challenging work environment.

¹⁷ Specific dimensions that spur economic growth include creation of skilled labor; concentration of information and expertise; support for basic research; development of new technology; improvement of the quality of life; and support for the service sector.

The study uses Denison's model of growth accounting (1964, 1985) to determine the real net social gain expressed as NPV per graduate.¹⁸ Using Denison's model as a basis the authors find that Texas gains \$60,000 per graduate, over and above other forms of public investment, by investing in education. This gain equates to a 12 percent real rate-of-return since 1970. The study concludes by noting that investment in education is both "sound and critical" for economic growth.

Illinois Study:

The study highlights both private and social monetary returns associated with higher education in the state of Illinois as well as non-monetary benefits (McMahon 1997a). Many of the non-monetary benefits associated with higher levels of education include improved health, home productivity, improved community involvement, lower rates of unemployment, reduced public aid, and lower crime rates.

The author notes that the high social rates-of-return on education denote that the higher education system is relatively efficient both internally and externally. Additionally, McMahon suggests that high rates of social return indicate that investment in higher education should be sustained, or gradually increased, relative to lower returning alternatives.

¹⁸ Denison estimates that education accounts for 42 per cent of annual growth of real national income (not segregated by level of attained education level).

The study uses a longitudinal analysis of graduates of Illinois public universities.¹⁹ Interestingly, the study notes that net-migration of Illinois graduates is close to zero; some graduates of Illinois schools leave the state, but immigrants of graduates from other states come to Illinois in about equal number. The rates-of-return methodology is an Elaborate Type IRR model. The real social returns, through the bachelor's level, for males is 16 percent and for females 15 percent. McMahon adds a 3 percent inflation factor to adjust the returns to a nominal 19 percent and 18 percent respectively. McMahon notes that this return compares favorably to other forms of investment:

- 5 percent for money market funds.
- 8 - 12 percent for long term corporate bonds.
- 13 percent long term total return on investment in physical capital in the United States, excluding real estate.
- 7 percent total return nationwide on real estate.

Tennessee Board of Regents Study:

A recent study for the Tennessee Board of Regents (TBR) presents rates-of-return for both genders categorized by high school graduates, associate degree recipients, four-year degree recipients, and those individuals that have completed an advanced degree, i.e., master's, doctorate, and professional degrees (Ukpolo and Dernburg 1998).

¹⁹ Tracer studies of Illinois graduates of public universities consisting of three large state-wide samples of public university graduates mostly contacted in 1994 who reported their earnings a year after graduation (Class of 1991), five years after graduation (1988), and ten years after graduation (Class of 1984).

The study uses the Elaborate Method to develop age-earning profiles for the education categories mentioned above. The profiles use data from the Current Population Survey, March 1993, with a total of 1,393 Tennessee labor-force participants age 19 and over. The authors assume that worklives begins at the ages of 19, 21, 23, and 25 then extend through the age of 65 for construction of the age-earning profiles, depending on the level of attained education.

The authors estimate that the state's subsidy for TBR institutions for 1993 is \$2,990 for two-year institutions and \$4,450 for four-year institutions. The study further assumes that the latter subsidy corresponds to the amount of state subsidy for advanced studies. These values form the basis for the "costs" to the state of Tennessee. The study suggests that 81 percent of earnings by former students are spent as consumption. This consumption spending plus a multiplier of 2.27²⁰ for induced spending yields a gross consumption value. This value forms the basis for evaluating differential consumption spending between different levels of attained education over a high school graduate. The additional tax collection associated with the differential spending is the benefit to the citizens of the state of Tennessee.

The tax collection is calculated by using the current 6 percent state sales tax plus an average 2.25 percent for local governments. This 8.25 percent total is applied against differential consumption spending and this tax collection is the benefit to the state.

All costs are based on a cross-sectional analysis using 1993 data. Accordingly, the study keeps all costs and benefits in real 1993 dollars. The rates-of-return calculations are

²⁰ Based on the US Department of Commerce, Regional Multiplier: RIMS handbook (1992).

the IRR of cost and benefits discounted by a 4 percent factor based on a consensus estimate of the historical real rates-of-return on invested capital in the United States. The estimated real social rates-of-return are listed below:

- Two-year: 16.0 percent .
- Bachelor' degree: 12.0 percent.
- Advanced degree: 12.0 percent.

The overall rate-of-return for TBR higher education institutions is 12.5 percent. The study adds an assumed inflation premium of 2.5 percent to adjust the real rate to a nominal rate-of-return of 15.0 percent. This nominal rate is compared to rates-of-return on alternate investments, with similar risk characteristics, available to the citizens of Tennessee: US Treasury 10 year securities and Corporate AAA bonds with nominal yields (1996 values) of 6.44 percent and 7.37 percent, respectively.

The study concludes that the rates-of-return associated with higher education offered by TBR institutions are highly beneficial to the residents of Tennessee when compared with other investments of similar risk.

Summary of State Rates-of-Return Studies:

The state studies find that there are positive returns to education; however, the returns vary significantly from study to study. The following table summarizes these findings:

Table 2.2 -- State Rates-of-Return Studies

Study	Method Employed	Rates-of-Return
Oklahoma Study (1995)	Elaborate Method - uses PUMS 1990 data (cross-sectional) data to develop age-earning profile; aggregated rates for above high school	8.0 percent nominal; 10.0 percent nominal with moderate out-migration
Alabama Study (1997)	IRR - Modified Elaborate Method; uses starting salary differentials extended over worklife for age-earning profile; data based on University of Alabama (UA) graduates; aggregated rates for UA graduates	4.3 percent real; 7.3 percent nominal
Texas Study (1987)	NPV and IRR Model using Denison's methodology for Social Accounting; aggregated rates including technology programs.	\$60,000 per graduate (NPV); 12.0 percent real since 1970
Illinois Study (1997)	IRR - Modified Elaborate Method; uses Illinois specific longitudinal data; returns through bachelors level	19 percent nominal for males; 18 percent nominal for females
Tennessee Board of Regents Study (1998)	IRR - Elaborate Method, uses cross sectional data developed for the March 1993 Current Population Survey.	Combined real rates-of-return: associate's: 16 percent. bachelor's: 12 percent. advanced: 12 percent.

The rates-of-return appear disparate; however, the following considerations explain a large amount of the variance among studies:

- The studies are based on different time periods with different inflation expectations and labor market supply and demand conditions.

- Differing economic expansion or multiplier effects associated with higher education earnings.
- Most studies use variants of the Elaboration Model to fit the structure of the study; these variants produce slightly different results.
- The data for the models are different; some models use US Department of Commerce cross-sectional survey data and some models use state specific longitudinal data.
- The construction of age-earning profiles differ among studies; some studies are for bachelor's degrees, while other studies are for differing levels of attained education (i.e., some college, associate's, bachelor's, etc.).
- Economic conditions may vary considerably from region to region and state to state.

All of the studies are consistent in demonstrating that the rates-of-return on education are positive and generally yield returns exceeding other forms of public investment.

Section 4: SUMMARY OF LITERATURE REVIEW

The review of subjects related to the relationship between education, productivity, earning, and rates-of-return demonstrates the complexity and diversity of this issue. By reviewing past studies of rates-of-return on education, one can easily visualize how the analysis and research has evolved and matured. At each step in the evolution, new issues and complexities of debate have added to the development of rates-of-return analysis. New data sources, better subdivisions of demographic data, improved statistical

techniques, and the synthesis of the on-going dialectic provide a more inclusive picture of the benefits associated with education, economic growth, and the resulting calculation of rates-of-return associated with education.

These advancements are certainly confirmed by McMahon's (1997b) analysis of the social benefits of life-long learning and the development of new methods analyzing rates-of-return to education (Arias and McMahon 1996). The use of synthesized material illustrates the growing maturity of rates-of-return studies.

There is nearly ubiquitous acceptance that the rates-of-return on higher education in the United States are high. While there may be debate about the proportion of economic growth associated with education, as discussed in prior sections of the chapter, there is a high degree of acceptance that education is a major contributor to economic growth. The co-mingled nature of explanatory variables contributing to economic growth makes it difficult to isolate the precise proportion with any degree of precision.

The various state level rates-of-return studies clearly indicate that returns to education are high and growing. Education returns suggest that further investment in education, both socially and personally, are indicated. The rates equal or exceed alternate social investments and the benefits far exceed the costs.

CHAPTER III

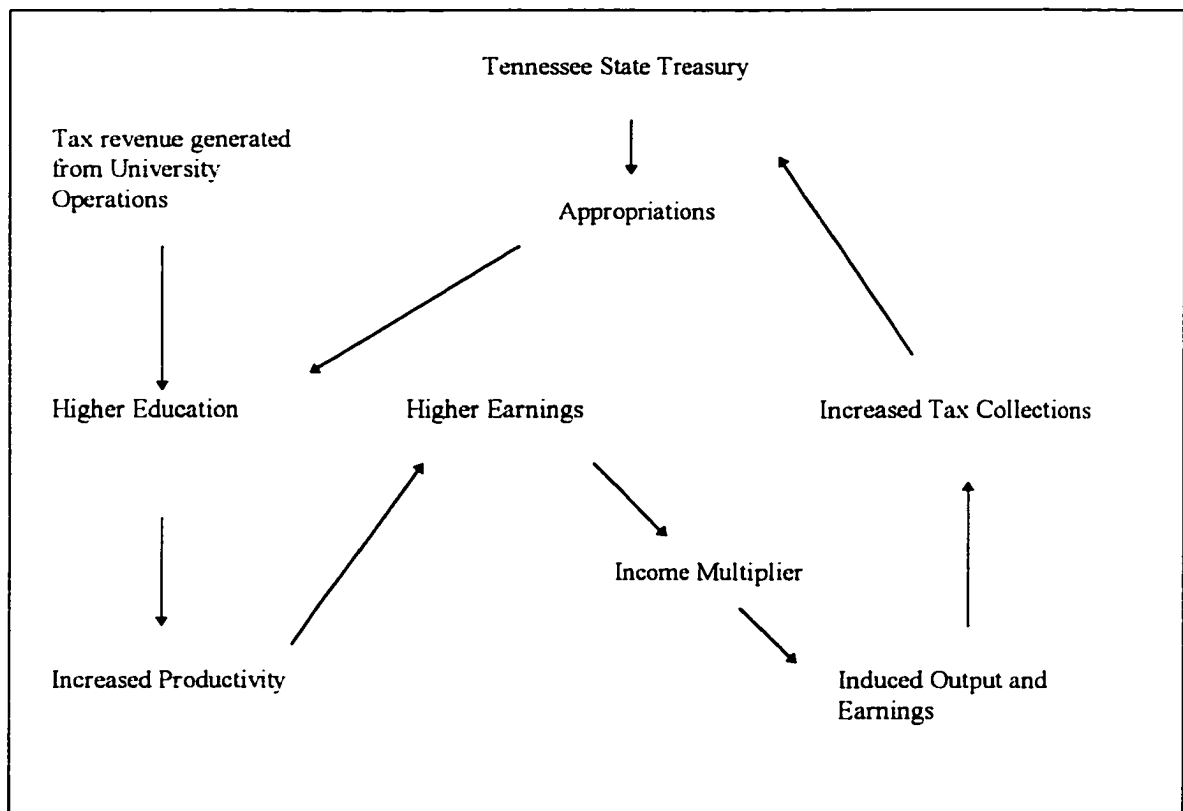
DATA PREPARATION AND ESTIMATING METHODS

This study applies, adapts, and extends the research of earlier studies on the social rates-of-return on higher education to the state of Tennessee. Estimation of the rates-of-return involves several steps:

- Identification of the net cost of subsidizing education.
- Estimation of the lifetime earnings associated with levels of attained education or age-earning profiles.
- Estimation of a workforce entry and migration profile.
- Estimation of induced earnings, the multiplier effects, associated with higher differential earnings.
- Estimation of increased tax collections or monetary returns to the public for subsidizing higher education.
- Estimation of the rates-of-return on higher education.
- Comparison of the rates-of-return on higher education to other forms of investment.

Very few, if any, of the state level rates-of-return studies fully estimate all facets of every module identified above. This study is no exception, also relying on Census data, established estimating methods, and estimates by agencies and researchers. The data are then adapted, or modified, to fit the unique features of Tennessee's revenue system, higher education system, and dynamic economy. The following figure illustrates the overall model employed in this study to determine the returns on higher education. Separate sections are dedicated to each module developed, the data source used, and the methodology that is employed in calculating the module estimate.

Figure 3.1 Tennessee Rates-of-Return on Higher Education Model



The estimation results are based on 1992 graduates from public institutions of higher learning in the state of Tennessee. Due to limitations in the availability of information, 1992 is the most recent year that contains most of the significant information required to estimate the modules.

Section 1: NET APPROPRIATIONS FOR HIGHER EDUCATION

This module is based on the expenditures for higher education by the state of Tennessee. Net appropriations for higher education form the basis for the social costs, or subsidization, of higher education by the citizens of the state of Tennessee. As a result, total expenditures must be adjusted to an appropriations basis and reduced by the tax collections on salaries associated with the higher education expenditures to estimate state higher education subsidies.

State appropriations and expenditures for higher education in Tennessee are captured in several documents:¹

- National Center for Education Statistics, State Higher Education Profiles.
- Budgeted and actual expenditures for higher education in the state of Tennessee provided by the Tennessee Higher Education Commission (THEC).
- Tennessee Comprehensive Annual Financial Report.

State Expenditure and Transfers, specifically Education and General (E&G) Expenses, represent the major categories of higher education support and forms the basis

¹ Appendix One contains the detailed breakdown of expenditures for Tennessee higher education for the academic year 1991-1992.

for calculation of state subsidized expenditures for higher education. The elements of this account are adjusted to reflect the salary expenditures. This adjustment is necessary in order to estimate tax collections associated with higher education salaries. The 1991-1992 academic year is used to estimate the total state subsidy for 1992 workforce entrants in Tennessee. This single year of expenditures contains all of the students in the Tennessee higher education system. As long as enrollment remains relatively steady, these expenditures are representative of the full cost of the education subsidy required to produce graduates, or dropouts, who enter the workforce. These E&G expenditures contain the full costs for freshman, sophomores, juniors, seniors, and graduate students; accordingly, the full pyramid of costs associated with the workforce entrants' full courses-of-study is captured by these expenditures in 1992 dollars. A variant of this method is employed in a study that develops the rates-of-return on higher education in the state of Oklahoma (Penn and Dauffenbach 1995). Use of this method uncomplicates the estimating procedure in several respects:

- Costs are captured in 1992 dollars precluding adjusting the workforce entrants subsidies from prior years for inflation.
- Records the actual expenditures for freshman, sophomores, juniors, seniors, and professional students that produce a graduate who will enter the workforce. This method precludes estimating when dropouts, with some college, actually leave college.

The actual expenditures, as accounted for by THEC by sub-category of the E&G expenditures, are multiplied by the salary factor to determine the dollar value of E&G

expenditures that are paid as salary.² Salaries, or earnings, are the input base for estimating tax collections.

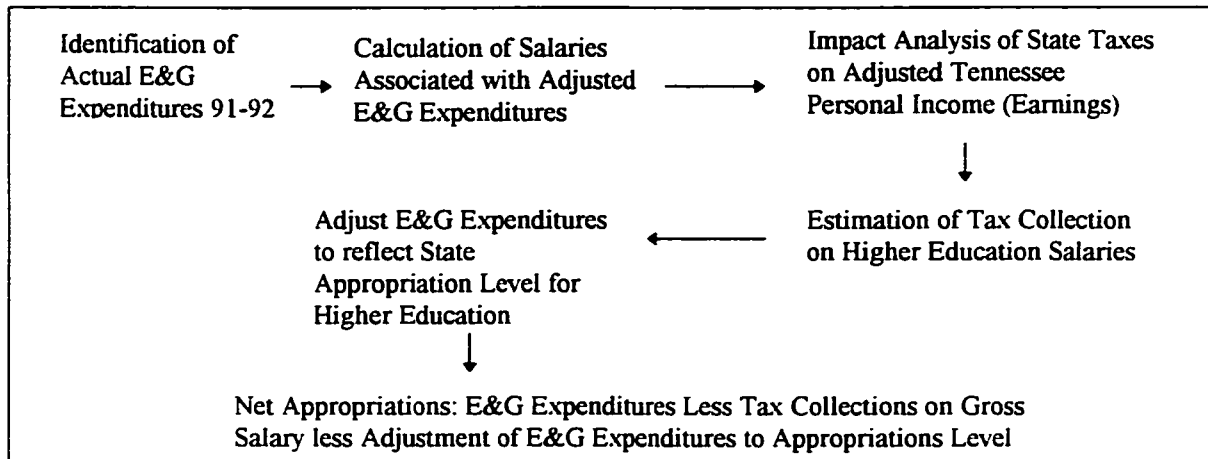
No income multiplier, or induced earnings, effects are applied against higher education earnings. Faculty and Staff salaries do not represent new or increased economic activity within the state of Tennessee. These salaries are paid from state tax revenue. Tax revenue represents a subtraction of income from the tax paying citizens of Tennessee. If the citizens of Tennessee retained their income used for higher education expenditures and followed traditional consumption patterns, or the state of Tennessee spent the higher education expenditure on other public programs, these expenditures would have multiplier effects in the Tennessee economy. Accordingly, higher education salaries are redistributions within the state of Tennessee without unique multiplier effects.

State appropriations for higher education represent 61.3 percent of total E&G expenditures.³ After the calculation of higher education salaries and associated tax collections, gross expenditures must be reduced by 38.7 percent, which reflects direct reimbursements to the state for higher education from tuition, fees, and other revenue sources. Adjusting E&G expenditures for tax collections associated with higher education salaries and for the state's portion of higher education funding yields net appropriations or net state subsidy for higher education. The net appropriations estimation model is diagrammed in the following figure:

² Table 10, National Center for Education Statistics, State Higher Education Profiles, 4th Edition, US Department of Education, Office of Educational Research and Improvement - NCES 92-347.

³ Calculated from Tennessee Higher Education Total Revenue of All Institutions Report for 1991-1992 provided by THEC.

Figure 3.2 Net Appropriations Model



Section 2: AGE EARNING PROFILE

The essential element in determining incremental earning is the development of the age-earning profile. The basic building block for the cross-sectional age-earning profile is data collected by the US Bureau of the Census.⁴ The sample data consist of a 5 percent sample of Tennessee residents from a broad demographic cross-section. A tremendous amount of data for each observation are available; however, to construct the age-earning profile the following data associated with each observation were collected:

- Sex: male or female.
- Age.
- Years of school: educational attainment.
- Income measured by earnings.

⁴ Data for the age-earning profile were developed using the Public Use Micro Sample (PUMS) 5% sample for the state of Tennessee, 1990. The earnings and attained earnings data were based on information current in 1989.

The age-earning profiles are estimated by gender and level of attained education. This segregation of male and female age-earning profiles allows for the development of separate rates-of-return by gender. This is necessary since males and females have different worklife patterns, earning patterns, and mortality characteristics. Each of these items are discussed in detail in this Chapter and in Chapter IV. The following categories are used to segregate the levels of attained education:

- No College.
- Some College.
- Associate's Degree - Technical.
- Associate's Degree - Academic.
- Bachelor's Degree.
- Master's Degree.
- Professional Degree.
- Doctoral Degree.

These categories correspond to those used by the US Bureau of Census in the collection of the sample data.

Table 3.1, on the next page, summarizes the sample size, percent of total sample, percent of attained education level percentage, and percent of sample by gender. The data, once segregated by level of attained education and gender, are averaged for each age in each age-earning profile, e.g., if there are 250 females age 26 that have a technical associate's degree in the sample data, then the actual earnings for these 250 females are

averaged and this averaged number is used as the age 26 earnings number for the respective age-earning profile.

Table 3.1-- Frequency Table for Earnings by Educational Attainment and Gender

Attained Education	Freq.	Percent of Total	Percent of Attained Education Level
No College:			
Male	36,851	28.85%	47%
Female	41,477	32.50%	53%
Some College:			
Male	10,693	8.38%	47%
Female	11,974	9.38%	53%
Associate - Technical:			
Male	1,288	1.01%	40%
Female	1,925	1.51%	60%
Associate - Academic:			
Male	1,044	0.82%	43%
Female	1,372	1.08%	57%
Bachelor's:			
Male	7,281	5.70%	52%
Female	6,635	5.20%	48%
Master's:			
Male	2,209	1.73%	48%
Female	2,409	1.89%	52%
Professional:			
Male	1,192	0.93%	70%
Female	508	0.40%	30%
Doctorate:			
Male	583	0.46%	76%
Female	184	0.14%	24%

This earnings averaging process is completed for all ages in each of the age-earning profiles. Once all these averages are accomplished, a regression is used to smooth the age-earning profile.⁵ The Elaborate Method, discussed in Chapter II, is used to

⁵ The age range for the data selected from the PUMS 5 percent sample for each level of attained education is 25-65 or a 41 year period.

accomplish the profile smoothing. For each level of attained education, by gender, a regression of the following form is used:

$$Earnings = \alpha + \beta_1 AGE + \beta_2 AGE^2$$

After the regression is run and the coefficients are estimated for the intercept and slope parameters, a new smoothed, average wage corresponding to each age, by gender, by level of attained education is predicted. These earnings predictions for each age are based on cross-sectional data in 1989 dollars.

The estimates are summed and compared against the “no college” level of attained education. The difference between these summed values is the differential lifetime income in 1989 dollars. Specifically, for this study, differential income is based on the difference between each respective level of attained education and the no-college baseline category. Hence, the rate-of-return calculation will be a differential rate-of-return over the no-college category.

The Consumer Price Index - U (All Urban Consumer) is used to adjust the 1989 dollars age-earning profile to 1992 dollars. The age-earning profile will be maintained in 1992 real dollars. The rates of productivity growth used in this study are the historical rates embedded in the sample data. These rates of productivity growth are unadjusted in the age-earning profile. Dynamic productivity changes are beyond the scope of this study.

Section 3: WORKFORCE ENTRY

The age-earning profiles are based on estimating smoothed average earning profiles. Smoothed profiles are useful in estimating differential wages for higher education groups during estimated worklives. However, a few estimating considerations must be introduced to adjust the worklife profiles of graduates who enter the workforce at each level of attained education such as the effects of migration and worklife expectancy as the 1992 workforce entrants move through their worklives.

Workforce participation is a significant factor in determining workforce entry. It measures the number of individuals who actually participate in the workforce out of the number of potential workforce entrants. As previously discussed, the PUMS 5 percent sample for the state of Tennessee provided the observations for estimating the age-earning profile. The collected PUMS data used for each profile include all observations which include the following possibilities for each observation in each age-earning profile category:

- The observed individual worked and reported earned income.
- The observed individual worked part-time and report earned income.
- The observed individual did not work and did not report earned income.

Accordingly, the participation rate for each category is embedded within the profile. The wages for each age in each age-earning profile is aggregated and averaged to construct the age-earning profile. As expected, some individuals did not work and did not have reported income; hence, the average wage, for each age category, was diluted.

Specifically, the average wage is lower since the denominator for the average wage includes the observed individual; however, the numerator is unaffected since the observed individual did not report wages. To preclude the possibility of double counting the effects of participation rates in the estimation of the rates-of-return, the workforce entry estimates used in the model do not include the effects of participation because these effects are already considered in the average wages.⁶

Worklife Expectancy and Mortality:

Estimates for worklife expectancy and mortality are based on 1995 data (Gamboa 1995). This study combines the effects of both mortality and education to determine the average worklife expectancy for males and females.

The data clearly reveal that a relationship exists between levels of education and worklife expectancy. For both males and females, as the level of education increases, up to fifteen years of higher education, the average worklife expectancy increases. Females continue to have higher probabilities of workforce exit and reentry than males.

Accordingly, females tend to have shorter average worklife expectancies than males.

Interestingly, an earlier worklife expectancy study by the US Department of Labor (US Department of Labor, Bureau of Labor Statistics 1986)⁷ finds that as male life expectancy increases the longevity is allocated to non-market activities. Female increased

⁶ The overall participation rate calculated for the PUMS 5 percent Tennessee sample is 66.97 percent for females and 79.56 percent for males, age 25 and over. This compares favorably against the national participation rates as reported by the US Department of Labor, Bureau of Labor Statistics for April 1997 as 60.2 percent for females and 76.9 percent for males, age 20 and over.

⁷ Based on a nationwide household survey conducted by the Bureau of Census on behalf of the Bureau of Labor Statistics (Current Population Survey).

life expectancy is allocated to labor market activities. The impact of education on health is not estimated. The following table summarizes worklife expectancies by levels of education. The age-earning profiles incorporate these worklife expectancies and age-ranges.

Table 3.2 -- Average Worklife Expectancies by Attained Education Levels

Education Levels	Male		Female	
	Worklife ⁸	Age Range	Worklife	Age Range
High School or Less ⁹	36	18-54	28	18-46
Some College	37	20-57	33	20-53
Associate's	37	20-57	33	20-53
Bachelor's ¹⁰	38	22-60	34	22-56
Master's	37	24-61	33	24-57
Doctorate/Professional	34	27-61	30	27-57

Migration:

The use of migration calculations to adjust the workforce total is a necessary consideration in determining the total number of individuals in each category of attained education that remain in the Tennessee workforce. Several approaches to workforce

⁸ Rounded to full years.

⁹ High School and Less Than High School categories worklife estimates are averaged to correspond with the composition of the High School age-earning profile category. Data based on Tables 1 and 2, Worklife Expectancies by Age, Gender, Race, and Disability Status; Education Criteria: 12 Years or Less and 12 Years.

¹⁰ The bachelor's, master's, professional, and doctoral levels are based on Table 4, Worklife Expectancies by Age, Gender, Race, and Disability Status; Education Criteria: 16 Years or More. The all races and non-disabled categories are used for worklife expectancy estimates. The attained education levels worklife expectancy estimates based on Table 4 will vary slightly due to different expectancy estimates associated with workforce entry age.

adjustment due to migration have been used, or suggested, in the literature review. This study evaluates two migration scenarios to develop distinct rates-of-return associated with each scenario. This multiple migration approach also serves as a sensitivity analysis, determining the rates-of-return sensitivity to changing migration patterns.

The no net-migration analysis serves as the primary scenario for estimating rates-of-return. It is assumed that net-migration equals zero. In essence, migration has a negligible effect on the workforce structure and is not worthy of estimating consideration. There is some support for this notion. Specifically, statistical data tracked by the United States Government show that Tennessee is one of the more stable states with lower levels of migration (US Bureau of the Census 1995). This 1995 release of data shows that in 1990 Tennessee had a population of 4,877,185 of which 69.2 percent, or 3,373,365 were born in Tennessee. This places Tennessee as 18th out of 50 states in the percent of its population living in Tennessee in 1990 that were born in Tennessee (native population retention). Using data available from the US Department of Census (Hansen 1995) Tennessee had net-migration into the state of 10,000 individuals during the March 1993-1994 period.¹¹ This shows that Tennessee benefits from a net gain in migration. Tennessee and Kentucky show a net in-migration in the East South Central Division, South Region. Most of Tennessee's migration is intra-regional or within the South Region. However, some of the net-gain consists of movement into the state from the Northeast and West Regions.

¹¹ Based on the US Department of Census, Population Characteristics Report P20-485, Table 21 page 70: In-migrants, Out-migrants, and Net Migration for Regions, Divisions and States.

Using regional data, the lowest level broken-down for levels of attained education by the US Bureau of Census is sufficient in developing the alternate migration scenario: net-migration by level of attained education. The southern region, as well as Tennessee, is a net-immigrant region for all age levels and all levels of attained education (age 25 and over). The tables below provide specific summaries of migration as they relates to age and attained education as a percent of the total for each respective category.

Table 3.3 -- South Region Mobility by Age (in thousands)

Age Category	Total in Category	Migrated (Net)	Percent in Category	Percent Per Year
Total	88,493	376	0.43%	
20-24	6,429	12	0.19%	0.038%
25-29	6,787	13	0.19%	0.038%
30-44	21,965	159	0.72%	0.048%
45-64	17,828	28	0.16%	0.008%

Table 3.4 -- South Region Mobility by Attained Education Over 25 Years Old (in thousands)

Attained Education	Total in Category	Migrated (Net)	Percent in Category	Percent of Total
Total	57,021	233	0.41%	
No College	31,804	122	0.38%	0.214%
Some College/Assoc.	13,612	37	0.27%	0.065%
Bachelor's	7,837	66	0.84%	0.116%
Graduate/Prof.	3,767	8	0.21%	0.014%

It is important to note that the figures in both tables above reflect a net-immigration of individuals at all levels of education and age. Net immigration signifies that the southern region and the state of Tennessee are net benefactors of migration.

The rates-of-return on education are potentially enhanced due to the inflow of individuals who have already attained a level of education from public or private institutions outside of the state of Tennessee and the region. Accordingly, the primary estimation, no migration, is conservative and is compared against the alternate migration scenario's rates-of-return in Appendix Ten. The net-migration case is beneficial in demonstrating the effects on the rates-of-return due to immigration and, conversely, out-migration.

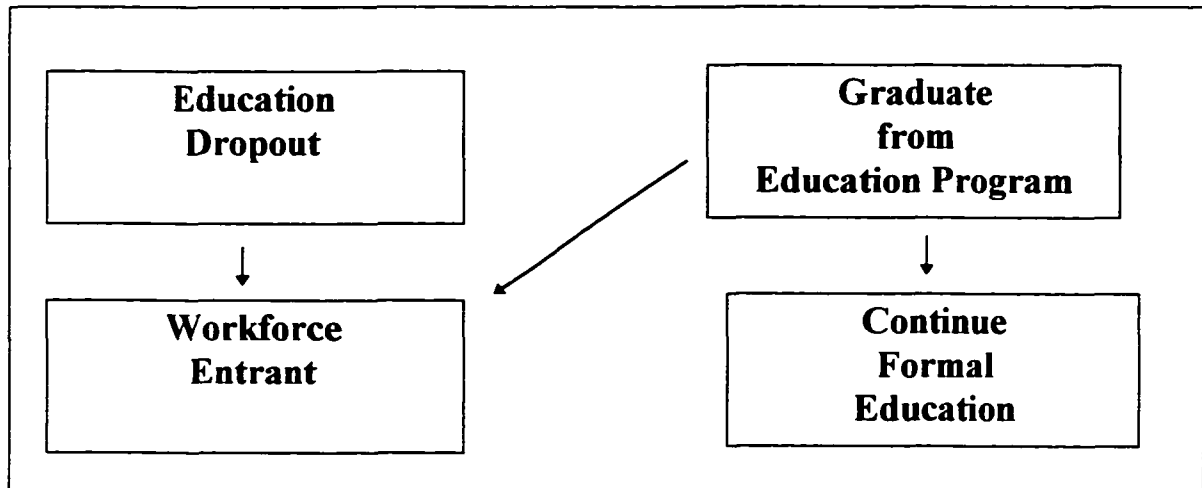
In the net-migration scenario the age limit for considering net migration is 44 years old. The migrations numbers are negligible after this age. This age limit is consistent with much of the literature discussed in Chapter II where migration tends to happen earlier in life when the present value of benefits is maximized and after periods where formal education is complete.

Initial Workforce Entry Model:

Most graduates of high school and higher education programs enter the workforce. Additionally, dropouts from education programs also enter the workforce. These potential entrants into the workforce must be modified by a reduction for the number of individuals who continue their education by entering other degree or professional

programs without a break between educational programs. The following figure depicts the characteristics of the Workforce Entry Model.

Figure 3.3 -- Workforce Entry Model



As noted in a previous section, participation rates are considered in the age-earnings profile model and are not considered in this portion of the model to prevent double counting participation effects.

The model illustrates the key estimates that must be developed are the dropout rate, graduation rate, and continuation rate for each level of education. After calculating initial workforce entrants for the respective levels of attained education above high school, the workforce is then adjusted for average worklife expectancies. These workforce estimates are then applied against the age-earning profiles to determine the aggregate income differentials.

THEC produces several reports that provide vital information to estimate workforce entry:

- **Persistence to Graduation by Institution (1986 cohort).** This report tracks fall cohorts of first-time (full-time) freshman beginning in fall 1986 through graduation during the 1991-1992 academic year. Freshman who begin in the preceding summer are included in this report. The students are matched for all Tennessee higher education institutions, not just the originating institution (i.e., if a student begins at a community college and graduates at another community college or four-year institution, the student is counted as persisting until graduation).
- **Degrees Awarded By Institution 1991-1992.**

The persistence report allows for the estimation of attrition or dropouts from the Tennessee higher education system. Those individuals who drop-out enter the workforce with “some college.” The total freshman cohort for 1986 was 18,647 composed of 12,956 students enrolled in four-year institutions and 5,691 students enrolled in two-year institutions.

The two-year institution graduation total (from all institutions) for 1992, based on the 1986 tracked freshman cohort, is 1,443 with 4,248 dropping out of school. The graduation rate is 25.4 percent and the attrition rate is 74.6 percent. Since students who begin at two-year institutions then transferred to four-year institutions, or other two-year institutions, to complete their education (continuation) are picked up as graduates in the

persistence report totals, the continuation rate is embedded in the four-year or other two-year graduation rate totals.

The 1992 graduation totals for four-year schools based on the tracked 1986 freshman cohort was 5,567. A total of 7,389 failed to complete their education during the 1986 to 1992 tracking period. This yields a 43.0 percent graduation rate and a 57.0 percent attrition rate. Unlike the two-year institutions, a continuation rate for four-year institutions must be calculated. The persistence report does not track the freshman cohorts into graduate or professional school.

Several sources exist that report the rate of continuation for four-year graduates (College Entrance Examination Board 1995 and 1997, Cass-Liepmann 1996). The rate for each of Tennessee's four-year institutions is weighted by the number of graduates from the respective institution and then averaged to arrive at an aggregate continuation rate of 20.9 percent.

The calculation for workforce entry then becomes relatively straight forward. The total graduates for each level of attained education is the base number. For two-year institutions, the graduation number is the number of workforce entrants. The continuation rates, for two-year schools, are embedded in the four-year schools graduation rates (based on the methodology used by THEC in the cohort analysis). For four-year institutions, the raw graduation total cannot be used as the workforce entry number. The graduation total must be reduced by the continuation rate of graduates who enter graduate or professional schools without a break in their education (20.9 percent). Graduates from graduate and professional programs are considered entrants to the workforce.

To estimate the number of workforce entrants who entered the workforce with “some college,” the attrition rate is used. Specifically, the graduation numbers for two-year and four-year graduations are divided by their respective attrition rates to yield a total number of students who began college. The number of graduates is then subtracted from the total number of students who began college and the difference reflects the number of students who dropped out. The totals for two and four-year institutions are summed and the number of students who earned certificates are added to this total to arrive at total workforce entrants with “some college.” The following table summarizes the calculation of the workforce entrant totals for 1992:

Table 3.5 -- Workforce Entrants

Education Level	Graduates Total	Attrition “Some College”	Continuation Total	Workforce Entry
Associate’s	4,948	14,532	N/A	4,948
Bachelor’s	12,468	16,527	2,606	9,862
Master’s ¹²	3,586			3,586
Doctorate	439			439
Professional	671			671
Certificate’s	848			included below
Some College ¹³		31,059		31,907
Total				51,413

The number of graduates is segregated by gender to allow proper subsidy allocations and subsequent calculation of the rates-of-return. The Degrees Awarded by

¹² Contains Education Specialist Degrees (EdS). Typically, there is some number of master’s student who do continue directly to the doctoral level; however, this is relatively insignificant for workforce entry calculations and is not considered as part of this study.

¹³ Summed value of attrition from two and four-year degree plus certificate total.

Public Institution Report provides the gender of degree recipients. Accordingly, the following table illustrates the representative percentages. The calculation of the “some college” category is based on the ratio of men to women in the summed certificate’s, associate’s and bachelor’s degree categories.

Table 3.6 – Workforce Entrants by Gender¹⁴

Education Level	Workforce Entry	% Males	Total Males	Total Females
Associate’s	4,948	36.7%	1,816	3,132
Bachelor’s	9,862	45.4%	4,477	5,385
Master’s	3,586	40.1%	1,438	2,148
Doctorate	439	58.1%	255	184
Professional	671	62.4%	419	252
Some College	31,907	42.7%	13,624	18,283

Section 4: DIFFERENTIAL EARNINGS CALCULATION

The age-earning profile is now combined with the workforce entry model. As previously discussed, only the earnings differential between high school and the respective attained education level are considered. The yearly earnings in the age-earning profiles are then multiplied by the adjusted workforce number.

The earnings by year are totaled for each level of attained education. As previously discussed, each level of attained education has a different worklife total. Once summed, each level of attained education by gender has a unique aggregate, or worklife, earning total in 1992 dollars. The constant 1992 profiles serve as the primary basis for estimating rates-of-return; however, nominal rates-of-return are calculated for each of the

¹⁴ This table does not consider the effects of participation rates, which are included in the age-earning profile.

different levels of attained education by gender to allow comparison to alternate investment opportunities that are stated in nominal value. The expected inflation rate used to adjust constant dollar estimates to nominal dollars is based on the Survey of Professional Forecasters (SPF) produced by the Federal Reserve Bank of Philadelphia.¹⁵ This forecast allows estimation of both real and nominal rates-of-return on higher education.

These summed real and nominal differential earnings values serve as a basis to calculate induced earnings and tax collections on a yearly basis. The cash flows from tax collections begin at age eighteen and continue until the end of the worklife expectancy for each age-earning profile. These cash flows form the basis for all positive cash flows for the generation of the internal rates-of-return (IRR), modified internal rates-of-return (MIRR) and net present values (NPV) calculations.

Section 5: INDUCED EARNINGS AND INCREASED TAX COLLECTIONS

The multiplier is derived from Impact Analysis for Planning (IMPLAN)¹⁶ data for the entire state of Tennessee. The multiplier's value of 1.428 is used to determine the induced earnings by year, i.e., multiply yearly differential earnings by 1.428. The multiplier is an income multiplier describing the spread effects of an increase in income,

¹⁵ Based on estimates of long-term inflation forecast quarterly survey . These data were formerly known as the ASA/NBER survey; now produced by the Federal Reserve Bank of Philadelphia, <http://www.phil.frb.org/econ/spf/cpie10.txt> for third quarter 1992. These data were extracted May 13, 1998.

¹⁶ IMPLAN was initially developed by the USDA Forest Service. IMPLAN represents the total direct, indirect, and internal effects attributable to the change in the economic input variable. If earnings are the input variable, IMPLAN estimates the total expansion of earnings in the economy associated with the initial change in earnings. IMPLAN allows for disaggregation of data considering primary spending habits of a target group; hence, IMPLAN multipliers can be used to explain the impact of target groups.

which estimates the economic effects of higher education differential earnings on total earnings in the state of Tennessee .¹⁷

The yearly earning differentials by year are multiplied by the income multiplier. The multiplier results are summarized in Appendix Seven. This incremental value represents the additional earnings, both in constant 1992 and nominal dollars by year, that are generated by economic activity associated with the differential earnings of individuals with formal education beyond high school.

Once the positive cash flows by year associated with differential earnings and induced earnings are established, a yearly estimate of increased tax collections is made. The methodology of tax impact analysis, discussed in the net appropriations section, Appendix One, and Appendix Two, is applied against the increased earnings. The taxes associated with these increased earnings are the cash inflows, or benefits, to the state associated with financing higher education.

Section 6: RATES-OF-RETURN

Rates-of-return estimation is similar to any capital budgeting model. The net appropriations are the subsidies, or cash outflows, to the state of Tennessee associated with higher education. The full year of net-appropriations calculated in Section 1 of this chapter, for all students, is representative of the costs for the full program of study for the

¹⁷ The IMPLAN multiplier model for the state of Tennessee was estimated by the Bureau of Economic Research Center at Middle Tennessee State University based on spending patterns of high income households (\$50,000 and up). Alternately, the RIMS II Input-Output Model direct-effects multiplier for earnings developed by the Bureau of Economic Analysis, US Department of Commerce is based on a particular sector of the economy explaining an increase in earnings of a particular branch of industry. Accordingly, the RIMS II model is inappropriate for estimating the induced earnings effects of differential earnings associated with higher education.

workforce entrants who have gained increased formal education. These higher education net subsidies are the 1992 present value costs (e.g., time period zero in the calculation).

The yearly increased tax collections associated with increased and induced earnings are the positive cash inflows to the state of Tennessee. The model generates returns from cash in-flows and out-flows to the state of Tennessee associated with higher education. These rates are reported as both real and nominal rates-of-return.

Separate rates-of-return are generated for each level of attained education beyond no college (high school or less). The following levels of education have separate rates-of-return:

- Some college.
- Associate's degree.
- Bachelor's degree.
- Master's degree.
- Doctorate.
- Professional degree.

Rates-of-return are generated for these education levels for both migration scenarios: zero net migration and estimated net migration. The migration rates-of-return are highlighted in Appendix Ten.

After estimation of real and nominal returns, the rates are compared against alternative forms of investment for the citizens of Tennessee with similar time horizons. The returns are compared against the returns associated with other investments that would be available if the appropriations for higher education were not undertaken and the

expenditures, through lower taxes, were retained by the individual citizen or alternatively spent on other public programs desired by the citizenry. Alternate investment examples include equities, bonds (various classes), and general inflation levels. It should be noted that these investments represent a wide range of risk that is discussed in the Chapter IV.

CHAPTER IV

EMPIRICAL ANALYSIS

This chapter reports the rates-of-return generated by the model. The first part of this chapter discusses the estimation of the various modules of the model. The last part of the chapter discusses the rates-of-return results under the different migration assumptions.

Section 1: NET APPROPRIATIONS FOR HIGHER EDUCATION

State Higher Education Subsidy:

The actual E&G expenditures for the state of Tennessee for the academic year 1991-1992 were \$1,003,998,494. This value represents the gross value of state higher education expenditures for the University of Tennessee system and the Tennessee Board of Regents systems. As indicated in Chapter Three, this annual expenditure accounts for all freshman, sophomores, juniors, seniors, graduate students, and professional students in the two systems. The E&G expenditures for 1991-1992, adjusted for tax collections on higher education salaries and levels of appropriations, are reflective of the education subsidy by the state of Tennessee for the graduating students and those who have some college but did not complete a degree. The expenditures by category are illustrated in the following table.

Table 4.1 -- E&G Expenditures by Category

Category of Expenditure	Actual 1991-1992 Expenditure
Instruction	\$517,415,863
Research	35,292,923
Public Service	46,580,011
Academic Support	95,330,024
Student Services	84,783,954
Institutional Support	108,602,982
Operation and Maintenance of Plant	94,284,044
Scholarships and Fellowships	<u>21,708,693</u>
Total	<u>\$1,003,998,494</u>

Determination of Net Appropriations:

E&G expenditures by category are used to estimate higher education salaries and associated tax collections. A salary factor associated with each of the categories of expenditure, listed in Table 4.1, is applied to estimate higher education salaries. The total salaries related to the E&G expenditures total \$632,886,677. The calculations, salary factor, and estimated salaries by category are presented in Appendix One.

The impact tax rate (current Tennessee state and local taxes divided by the earnings portion of state personal income for 1992) is estimated at 9.37 percent of Adjusted Tennessee Personal Income (ATPI). The ATPI represents the earnings portion of Tennessee Personal Income. Taxes, specifically use and sales taxes, are subject to significant fluctuations; accordingly, an impact or current rate of tax collection relative to

earnings is used to estimate future tax collections. The detailed calculations are illustrated in Appendix Two.¹ Since the impact rate is based on ATPI, it can be directly applied against the salaries associated with E&G expenditures. The tax collection estimates associated with higher education salaries are calculated in Appendix One. Net appropriations are calculated as gross E&G expenditures less the tax collections associated with higher education salaries less the state appropriations adjustment discussed in Chapter III:

Gross E&G Expenditures	\$1,003,998,494
Less, tax collections	59,286,419
Less, 38.7 percent of Gross E&G Expenditures	<u>\$388,547,417</u>
Net Appropriations	<u>\$556,164,658</u>

The true cost to the state citizens to subsidize higher education is the net appropriations. This amount represents the total net expenditure by the citizens of Tennessee required to produce higher education graduates and higher education dropouts who enter the workforce with some college. The estimating techniques, as discussed in Chapter III, yield the \$556,164,658 net subsidy as a present value cost (1992) which, once allocated to the appropriate categories of attained higher education by gender, enters into the social rates-of-return calculations.

¹ Actual total tax collections by category for 1992, as recorded by the Tennessee Department of Revenue are listed in Appendix Three.

Section 2: AGE-EARNING PROFILES

The results of the regressions to fit the age-earning profiles segregated by level of attained education and gender are provided in the following tables:

Table 4.2 -- Male Age-Earning Profiles by Level of Attained Education

Level of Attained Education	Constant t-ratio	Age t-ratio	Age ² t-ratio	R ²
No College	-25,581.5 -11.2	2,060.2 19.3	-24.0 -20.4	.92
Some College	-53,548.6 -7.8	3,591.4 11.2	-38.7 -10.9	.76
Associate-Tech.	-30,711.0 -1.9	2,622.8 3.4	-29.4 -3.5	.2
Associate-Academic	-80,032.5 -5.2	5,093.8 7.1	-57.2 -7.2	.56
Bachelor's	-93,596.5 -10.5	5,953.5 14.4	-64.2 -14.0	.84
Master's	-85,935.8 -10.6	5,630.2 14.9	-60.8 -14.6	.85
Professional	-130,446.0 -4.8	7,847.5 6.2	-80.2 -5.8	.55
Doctorate	-131,655.0 -5.4	7,749.6 6.8	-81.7 -6.6	.55

Table 4.3 – Female Age-Earning Profiles by Level of Attained Education

Level of Attained Education	Constant t-ratio	Age t-ratio	Age ² t-ratio	R ²
No College	-7,207.9 -9.5	778.8 22.2	-9.7 -25.0	.97
Some College	-13,149.3 -6.3	1,273.1 13.1	-15.3 -14.3	.88
Associate-Tech.	-7,296.5 -1.4	1,128.2 4.5	-13.9 -5.1	.51
Associate-Academic	-13,253.1 -1.8	1,493.3 4.3	-18.8 -4.9	.53
Bachelor's	-3,084.6 -0.9	1,126.7 7.0	-15.1 -8.6	.85
Master's	-20,732.5 -3.6	1,994.9 7.4	-22.2 -7.4	.57
Professional	-12,787.0 -0.5	1,802.8 1.6	-20.4 -1.6	.27
Doctorate	-30,574.2 -1.0	2,378.3 1.7	-22.7 -1.4	.12

The Elaboration Method regression, as discussed in Section 1 of Chapter II, is used to smooth the sample data to create the age-earning profile. The age-range (25-65) of the sample data results in forty-one periods in the smoothing regressions for both males and females.

The 1989 dollar smoothed age-earning profiles results, adjusted for worklife expectancies as discussed in Chapter Three, are fully detailed by year in Appendix Four. The age-earning profiles adjusted to 1992 dollars² are highlighted in Appendix Five. The construction of the age-earning profile forms the basis to calculate differential earnings,

² The age-earning profiles are adjusted using the CPI-U (seasonally adjusted) from June 1989 (124.1) to September 1992 (141.2). This results in a 13.77 percent increase in earnings from 1989 to 1992. The PUMS 5 percent sample uses 1989 data and June 1989 reflects a midpoint of data. Most students receive jobs after the summer of the year they graduate; hence, September 1992 is the endpoint of the earnings adjustment for inflation.

induced earnings associated with differential earnings, and increased tax collection associated with increased statewide earnings resulting from higher levels of education.

Prior to calculating other modules that are by-products of the age-earning profile, the workforce entry data and the distribution of the education subsidies must be estimated.

Section 3: WORKFORCE ENTRY AND SOCIAL COST DISTRIBUTION

Workforce Entry:

The initial workforce entry number is critical in determining the total benefits that society derives from higher education. An abstract of Table 3.6, Workforce Entrants by Gender, is reproduced as Table 4.4 below showing net entrants into the Tennessee workforce. The *workforce entry* column numbers in Table 4.4 does not include graduates who are continuing their education and not entering the workforce in 1992.

Table 4.4 -- Workforce Entrants Summary, 1992

Education Level	Workforce Entry	Total Males	Total Females
Some College	31,907	13,624	18,283
Associate's	4,948	1,816	3,132
Bachelor's	9,862	4,477	5,385
Master's	3,586	1,438	2,148
Professional	671	419	252
Doctorate	439	255	184
Total	<u>51,413</u>	<u>22,029</u>	<u>29,384</u>

These workforce entry numbers do not consider the effects of workforce participation rates³ or migration. These numbers form the base case: no migration effects on workforce entry.

Social Cost Allocation:

The workforce entry numbers form the basis for the allocation of the social costs of education (subsidy) to each level of attained education. Table 4.5 illustrates the allocation of net appropriations to each category of higher education. The *total number* column reflects the number of people attaining a specific level of education and forms the basis for cost allocation. The total amount of state subsidy that must be allocated is \$556,164,658. The allocation is based on the graduating class of 1992, and includes those that left college with “some college.”

Table 4.5 -- Allocation of State Education Subsidies by Level of Attained Education

Level of Attained Education	Total Number	Equiv. Years	Total Years	Percent of Total	Allocated Costs
Some College	31,907	2	63,814	47.2%	\$262,509,719
Associate's	4,948	2	9,896	7.3%	\$40,600,020
Bachelor's	12,468 ⁴	4	49,872	36.9%	\$205,224,759
Master's	3,586	2	7,172	5.3%	\$29,476,727
Professional	671	4	2,684	2.0%	\$11,123,293
Doctorate	439	4	1,756	1.3%	\$7,230,140
Total	<u>54,019</u>		<u>135,194</u>	<u>100%</u>	<u>\$556,164,658</u>

³ Workforce participation rates are embedded in the average earnings of the age-earning profiles. See Chapter III, Section 3, for a full discussion of workforce entry and participation rate methodology.

⁴ Of these 12,468 bachelor's degree graduates, 2,606 immediately continued their education at the graduate or professional levels. Accordingly, these 2,606 graduates did not enter the workforce in 1992 but are considered for cost allocation purposes.

The allocation of dollars is based on a simple weighting by number of idealized equivalent years in each respective program, i.e., total graduates multiplied by the ideal years to arrive at an extended total years. Then the total years by category are divided by the total years for all categories to arrive at a percent of the total. This percent is multiplied by the total costs, \$556,164,658 to arrive at an allocated cost by category.

This method has some deficiencies, such as not recognizing the intensity of resource support by year for each level of education. However, many graduate programs use graduate students at nominal wages to advance research activities at a university or teach classes at assistantship wages. Accordingly, there are some offsets to the intensity of costs at the advanced levels of education and these offset considerations are beyond the scope of this study. Each method of allocation will produce some bias; however, the method depicted in the above table provides a useful method to allocate public subsidies to education. The costs are further allocated between males and females to arrive at a final distribution. It is further assumed that the allocation of costs between academic and technical associate degrees is roughly equal. The data presented in Table 3.6, Workforce Entrants by Gender, form the basis for public subsidy cost allocation by level of attained education by gender. These allocations are depicted in the following table.

Table 4.6 -- Allocation of State Education Subsidies by Level of Attained Education and Gender

Level of Attained Education	Allocated Costs	Percent Males	Allocated Costs Males	Allocated Costs Females
Some College	\$262,509,719	42.7%	\$112,091,650	\$150,418,069
Associate's	\$40,600,020	36.7%	\$14,900,207	\$25,699,813
Bachelor's	\$205,224,759	45.4%	\$93,172,041	\$112,052,718
Master's	\$29,476,727	40.1%	\$11,820,168	\$17,656,559
Professional	\$11,123,293	62.4%	\$6,940,935	\$4,182,358
Doctorate	<u>\$7,230,140</u>	58.1%	<u>\$4,200,712</u>	<u>\$3,029,428</u>
Total	<u>\$556,164,658</u>		<u>\$243,125,713</u>	<u>\$313,038,945</u>

Once all workforce entrants are accounted for and the public subsidy for their education is allocated, the next step is to estimate the benefits, or cash-flow stream, accruing to the state from total increased earnings. The benefits are the tax collections associated with the workforce entrants differential earnings and the induced earnings.

Section 4: DIFFERENTIAL EARNINGS

The resulting lifetime earnings differentials between “no college” and each respective level of attained education in 1992 dollars are summarized in the following table.⁵

⁵ Appendix Six contains the earnings differential by year and by age for each level of attained education (corresponding to the age-earning profiles). These differentials are in 1992 dollars and no time value considerations are taken into effect.

Table 4.7 – Male and Female Earning Differentials by Level of Attained Education

Level of Attained Education	Females	Males
Some College	\$207,457	\$360,890
Associate-Technical	\$307,059	\$383,246
Associate-Academic	\$324,773	\$439,622
Bachelor's	\$416,255	\$908,103
Master's	\$597,481	\$945,627
Professional	\$659,596	\$1,425,172
Doctorate	\$736,556	\$1,083,320

As expected, the earning differentials reflect higher earnings associated with higher levels of attained education. Additionally, female differential earnings tend to be lower than males. A significant amount of this difference is due to different average earning levels and participation rates; however, some of the difference is due to the reduced number of years of workforce life expectancy for females relative to males.

Section 5: INDUCED EARNINGS AND INCREASED TAX COLLECTIONS

Induced earnings associated with higher differential earnings are estimated using the earnings multiplier described in Chapter Three.⁶ The differential earnings combined with the associated induced earnings in the Tennessee economy equal total increased

⁶ The multiplier rate is 1.428 developed using IMPLAN data. The multiplier estimate was developed by the Business and Economic Research Center of Middle Tennessee State University.

earnings, which forms the base to estimate additional tax collections or financial benefits to the state for investing in higher education. The estimated total increased earnings for males and females are shown in Appendix Seven. The tax collections associated with these total increased earnings for males and females are summarized in Appendix Eight. The estimates in Appendix Seven and Eight are on a per-individual basis; however, to calculate the rates-of-return associated with each level of attained education the tax collection must be extended by the total number of individuals entering the workforce. This extension is taken into consideration in the rates-of-return estimates.

Section 6: RATES-OF-RETURN

This section uses the products of the prior modules to calculate the social rates-of-return on higher education in the state of Tennessee. The steps involved in estimating the rates include allocating net appropriations by level of attained education, determining the financial benefits to the state (increased tax collections), and then determining the various measures of return such as internal rates-of-return (IRR), modified internal rates-of-return (MIRR), and net present values (NPV). Additionally, a NPV per individual workforce entrant estimate is calculated by dividing total NPV per higher education category by the number of workforce entrants for each category.

To evaluate the IRR, and to calculate the MIRR and NPV, an appropriate real discount factor must be estimated. The most appropriate discount factor is the real rate-of-return on relatively risk free financial assets. This factor is calculated in the first part of this section.

Once the discount factor is estimated, the real rates-of-return by level of attained education and gender are calculated. An overall rate-of-return for all levels of higher education by gender is also provided as a metric to compare against other state investment opportunities. As stated earlier, the rates are calculated on the assumption of no migration. The state of Tennessee is a net benefactor of migration for levels of attained education above the high school level. Alternate rates-of-return are calculated for each category considering net migration. While these rates do not have a direct financial interpretation associated with the rates-of-return calculations, they provide an analysis of the sensitivity of the rates-of-return to migration patterns. The net migration rates-of-return are compared in Appendix Ten.

The rates are adjusted to nominal values by adding the inflation premium to the real rates. Calculation of nominal rates is necessary to facilitate comparison among alternate forms of investment that the citizens of Tennessee can make in-lieu of higher education expenditures.

Real Discount Factor:

According to Brigham and Gapenski (1997), the real risk-free cost of capital is not static and has recently ranged between 1 - 4 percent. The rate depends on economic conditions, returns that borrowers expect to earn on productive assets, and individual time preferences for current versus future consumption. Levy (1998) calculates the real rate of return as:

$$r = [(1 + \text{nominal cost of capital}) / (1 + \text{expected inflation rate})] - 1$$

For purposes of this study, a nominal financial asset with risk characteristics similar to other forms of government investment is the ten-year US Treasury Security. When using the ten-year US Treasury Security instrument, only an inflation premium and a maturity risk premium exists; accordingly, the resulting real rate reflects expectations in 1992 when the graduates entered the workforce. Using the data from the Federal Reserve Bank of St. Louis, the rate for a ten-year security in September 1992 was 7.65 percent.⁷

The expected inflation in the third quarter is based on the Survey of Professional Forecasters (SPF) produced by the Federal Reserve Bank of Philadelphia.⁸ This forecast reflects market expectations of the inflation premium over the life of the ten-year treasury security. The ten year SPF inflation forecast for the third quarter of 1992 was 3.75 percent, which reflects expected inflation over a ten-year horizon. Using Levy's method of estimating the real cost of capital rate yields:

$$r = [(1 + .0765) / (1 + .0375)] - 1, \text{ or } 3.759 \text{ percent}$$

⁷ Based on the ten-year Treasury constant maturity rate averages of daily figures. series GS10. <http://www.stls.frb.org/fred/data/irates/gs10> for September 1992. These data were extracted May 13, 1998.

⁸ Based on estimates of long-term inflation forecast quarterly survey. These data were formerly known as the ASA/NBER survey; now produced by the Federal Reserve Bank of Philadelphia. <http://www.phil.frb.org/econ/spf/cpie10.txt> for third quarter 1992. These data were extracted May 13, 1998.

Accordingly, the real discount rate is 3.759 percent, which is between the 1 and 4 percent range discussed by Brigham and Gapenski.

Real Rates-of-Return:

The rates-of-return are based on calculations of the IRR, MIRR, and NPV. Each method employs different assumptions and provides slightly different information about the rates-of-return associated with higher education in the state of Tennessee. However, all of the data arrays used to calculate the rates are identical.

The data begin with time period zero or graduation in 1992. The state subsidy costs are in 1992 or present value dollars. These costs enter the calculation as a negative number or net cash outflow to the state of Tennessee.⁹

The IRR method is widely used in state higher education rates-of-return studies and provides a useful measure of considering whether the rate generated equals or exceeds the real cost of capital, or hurdle rate, in this case 3.759 percent. While the IRR method is widely used in human capital studies, it is not the preferred measure employed by finance professionals when evaluating capital budgeting decisions (Brigham and Gapenski 1997). The internal rate-of-return (IRR) is the interest rate that equates the present value of the benefits (cash inflows) to the costs (cash outflows). A major assumption is that all cash

⁹ Subsequent cash outflows or inflows are in foregone taxes while the individual pursues higher education (cash outflow). Individuals pursuing higher education have a high school diploma, or equivalent, and if they did not pursue higher education would presumably work and pay taxes. Accordingly, the lost tax revenue represents an opportunity cost to the state and must be considered as part of the overall subsidy. At the point where individuals, for each respective level of attained education, enter the work force generating earnings, induced earnings, and increased tax collection a positive cash inflow begins to accrue to the state. These positive cash inflows persist through the expected worklife for each level of attained education subject to the estimation of benefits described in previous sections.

inflows, or tax collections in this case, are invested in projects that generate a rate-of-return that equals the generated IRR for the worklife of the graduating cohort. This underlying assumption of reinvestment is heroic considering that the expected worklife ranges between 25-39 years.

The MIRR calculation also discounts the present value of cash outflows and cash inflows to arrive at a rate that equates the benefits and costs. However, unlike the IRR, the MIRR assumes that the reinvestment rate is the real cost of capital rate. This reinvestment assumption is more realistic than the IRR reinvestment assumption. The state can use the positive cash inflows related to higher education to fund any state project as long as it meets, or exceeds, the real cost of capital hurdle rate and the MIRR reflects this logic. This study reports both the IRR and the MIRR, but general references to “rates-of-return” in this study refer to the MIRR.

The NPV calculation uses the real cost of capital rate as the discount rate for cash inflows; however, the NPV provides a different type of information than IRR or MIRR. The NPV is a dollar representation, in 1992 dollars, that reflects the amount of money returned to the state of Tennessee after recoupment of the state subsidy for higher education. This value is useful in comparing among programs on the basis of dollar returns. Rates-of-return, such as MIRR, are useful but theoretically NPV is the superior measure, particularly in investment decisions involving uncertainty (Brigham and Gapenski 1997). If the state seeks to maximize actual tax collections, further contributions to programs that generate the highest NPV per individual are the more useful metric.

The IRR, MIRR, NPV, and the NPV calculation per individual for 1992 workforce entrants are listed in Appendix Nine. The rates are broken down by levels of attained education by year. The following table provides a summary of the analysis.

Table 4.8 -- Summary of Real Rates-of-Return on Higher Education in Tennessee

Level of Attained Education	IRR	MIRR	NPV	NPV per individual ¹⁰
MEN:				
Some College	6.20%	5.21%	\$108,975,030	\$7,999
Associate's-Technical	8.76%	5.94%	\$11,553,205	\$3,181
Associate's-Academic	6.90%	5.51%	\$10,695,676	\$2,945
Bachelor's	6.54%	5.27%	\$95,855,644	\$21,411
Master's	10.16%	6.82%	\$49,702,753	\$34,564
Professional	8.39%	6.13%	\$18,764,628	\$44,784
Doctorate	7.07%	5.52%	\$7,281,405	\$28,555
Overall	6.81%	5.38%	\$302,828,341	\$13,747
WOMEN:				
Some College	5.23%	4.50%	\$56,297,948	\$3,079
Associate's-Technical	8.68%	5.73%	\$16,337,987	\$10,433
Associate's-Academic	8.99%	5.86%	\$17,994,358	\$11,491
Bachelor's	4.44%	4.08%	\$16,620,131	\$3,086
Master's	9.51%	6.51%	\$47,395,120	\$22,065
Professional	6.27%	5.11%	\$3,818,673	\$15,153
Doctorate	6.41%	5.27%	\$3,200,296	\$17,393
Overall	5.75%	4.76%	\$161,664,513	\$5,502

All of the rates-of-return exceed the real cost of capital and represent good value to the state in real terms; however, the rates for males tend to exceed the rates for females. To a large extent this result is due to longer expected worklives for males, higher average wages reflected in the age-earning profiles, and higher participation rates.¹¹ These factors

¹⁰ NPV total divided by the number of workforce entrants by level of attained education by gender as listed in Table 4.4.

¹¹ As discussed in Chapter III, this lower average wage in the age-earning profile includes the diluting effect of workforce participation rates.

tend to reduce the cash inflows to the state (benefits) and reduce the rates-of-return for females.

As stated in Chapter Three, these rates are differential rates over individuals with no college, i.e., high school or less. Several of the rates-of-return associated with levels of attained education stand out for both males and females. Combining these rates with NPV estimates provides ample evidence that education, in general, and several specific programs provide high rates-of-return to the state of Tennessee.¹²

Nominal Rates-of-Return and Comparison of Alternate Investments:

The inflation premium of 3.75 percent is added to the real rates-of-return to adjust the returns to nominal values. The inflation premium is based on expected inflation from 1992 until 2002. Accordingly, it represents a major portion of the yield curve for the periods estimated by the age-earning profile. The following table summarizes the nominal rates.

¹² An alternate migration scenario produced little to no significance with respect to the rates-of-return. The results are summarized in Appendix Ten.

Table 4.9 – Nominal Rates-of-Return by Level of Attained Education By Gender

Level of Attained Education	Nominal Rates-of-Return
MEN:	
Some College	8.96%
Associate's-Technical	9.69%
Associate's-Academic	9.26%
Bachelor's	9.02%
Master's	10.57%
Professional	9.88%
Doctorate	9.27%
Overall	9.13%
WOMEN:	
Some College	8.25%
Associate's-Technical	9.48%
Associate's-Academic	9.61%
Bachelor's	7.83%
Master's	10.26%
Professional	8.86%
Doctorate	9.02%
Overall	8.51%

During September 1992, the average daily yield for ten-year US securities was 7.65 percent. This security represents an investment with no default risk and exhibits similar characteristics to the investment made by the citizens of Tennessee in higher education.

To evaluate the efficacy of investing in higher-education one must consider alternate investments that the citizens of Tennessee could have made in 1992. In the third quarter of 1992, the Survey of Professional Forecasters made the following forecasts of investment returns over a ten-year horizon (1992-2001).¹³

¹³ Based on SPF forecast survey. These data were formerly known as the ASA/NBER survey; now produced by the Federal Reserve Bank of Philadelphia, <http://www.phil.frb.org/econ/spf/mean.txt> for third quarter 1992. These data were extracted May 13, 1998.

- Stock returns (S&P 500): 9.61 percent.
- Ten-year US Treasury bond returns: 7.44 percent
- CPI inflation rate: 3.76 percent.
- AAA Corporate bond yield: 8.11 percent.

Based on these expected returns, the overall male and female nominal rates-of-return on higher education exceed the fixed income investment alternatives, i.e., government and high quality investment grade corporate bonds.¹⁴ Since tax collections based on enhanced earnings are closer in risk and cash-flow characteristics to the fixed income market, the rates on these fixed income bonds represent a proper comparison to higher education rates-of-return. In some cases, nominal returns generated by the state's investment in higher education exceed expected returns on higher risk equities.

Viewing alternate investment returns over a long time period makes the nominal returns on higher education look more appealing. According to Bodie, Kane, and Marcus (1998) the following categories reflect the average total rates-of-returns for various investment vehicles, as measured from 1926 through 1996.¹⁵

- Large company stocks: 10.5 percent.
- Small company stocks: 12.6 percent.
- Long-term government bonds: 5.0 percent.

¹⁴ The rates-of-return are sensitive to tax rate fluctuations. An analysis of return sensitivity reveals that the overall male rate-of-return varies directly with changes in tax rates at the rate of 0.2553 percent for every 1 percent change in tax rate. The overall female rate-of-return varies directly at the rate of 0.3138 percent for every 1 percent change in tax rate.

¹⁵ Based on average investment returns during the period 1926-1996. Risk is measured by standard deviation or actual return volatility from expected returns. Bodie, Kane and Marcus (1998) note that those investments that exhibit the highest long-term yields also have the highest levels of volatility.

- Inflation: 3.1 percent.

Using the above returns as long-term metrics to compare anticipated higher education returns, all higher education returns significantly exceed long-term inflation and fixed income investments. Once again, a few of the higher education returns compare favorably with the average long-term equity returns for large companies without the high level of volatility, or risk, associated with equity instruments.

Higher education in Tennessee is a good investment for the citizens of Tennessee. The rates-of-return exceed both anticipated intermediate and long-term returns on comparable investments.

CHAPTER V

EDUCATIONAL ASPECTS

The purpose of this chapter is to relate this study to the teaching of economics and finance. This study investigates the linkages between human capital, productivity, increased wages, and social returns to the state of Tennessee from investment in higher education. The results indicate a strong relationship between human capital investment in the form of higher education beyond high school and increased income levels.

The subject matter contained in this study fits well into microeconomic, macroeconomic, labor economic, and public finance courses, at both the undergraduate and graduate levels. Human capital is extremely important in both public and private business decision making. Graduates of both economics and business programs should have a strong awareness of the benefits of human capital to their organization and how to measure these benefits. Historically, this material may not have been presented in introductory or intermediate classes due to a lack of relevant applied material. This chapter provides a conceptual framework that encourages instructors to use an adaptation of this study for classroom presentation. The other major educational implications of this study concern policy issues associated with higher education funding.

The first section of this chapter lists objectives, in a question format, to be achieved in introducing human capital and social rates-of-return studies to students. The next section highlights suggestions to assist instructors in achieving the objectives. The third section presents a testing strategy that can be used to determine the effectiveness of the teaching steps and exercises. The last section addresses issues pertinent to higher education planners.

Objectives:

When the portion of the course concerned with human capital and social rates-of-return studies is complete, the students should be able to answer the following questions.

1. What is human capital?
2. What are the differences between human capital investment and consumption?
3. How does human capital translate into increased productivity?
4. How does increased productivity translate into increased wages?
5. What is the difference between private and social rates-of-return on higher education?
6. What is an age-earning profile and how is it developed?
7. What are the methods that can be used to develop rates-of-return on public programs?
8. What are the economic transmission mechanisms from public expenditures on education to changes in aggregate supply and aggregate demand?

9. What are some of the major objections to the human capital approach?
10. What are the societal and private benefits associated with human capital investment in higher education?
11. What factors can affect rates-of-return analysis?

Questions one through five are general objectives appropriate for inclusion in all of the courses previously mentioned. These objectives form a general base that is appropriate for all economics and business students. Questions six and nine should be added for microeconomic courses. Questions eight and nine should be added for macroeconomic courses. Questions six, seven, nine, ten, and eleven should be added for public finance and labor economics courses.

Instructional Suggestions:

The instructor should emphasize a combination of in-class discussion, research projects, and hands-on exercises using econometric software and spreadsheet software to achieve the human capital learning objectives. The literature search in Chapter II is useful in preparing materials for in-class discussion and research analysis for objectives one through five. It is suggested that the instructor present materials that connect the objectives to the general subject being studied, i.e., microeconomics, macroeconomics, labor economics, or public finance.

Initially, presenting the material in an overarching fashion and connecting it to the primary area of study provides a relevant schemata, or intellectual structure, to assist

students learning. Once the intellectual frame work is established, additional substructure or detail can be added. This structuring process allows the students to assign meaning to the new material and allows for a deeper understanding of the new material by connecting the new material to the existing schemata (McKeough and Lupart 1991).

After presenting the material in a structured fashion and establishing the schemata, allow students an opportunity to continue their exploration of human capital with a focused reading of relevant sources then report on the findings. These activities add additional building blocks to the existing schemata. McKeough and Lupart (1991) further point out that the level of schemata development figures prominently in reading comprehension. Accordingly, reading without prior in-class presentation and schemata development is less effective in achieving student mastery of the human capital objectives.

In-Class Presentation of Human Capital:

The instructor should present a general sketch of the material including a review of the classic human capital material such as the works of Mincer, Becker, Schultz, and Psacharopoulos. To differentiate between human capital investment and consumption, a quick review of some the controversial issues such as signaling theory, labor market segmentation, and other critiques of human capital should be introduced.

Class Discussion:

The controversial issues create excellent opportunities for lively in-class discussions. Since students are actively involved in the human capital development

process, they can immediately relate to the material and actively engage in discussion. During the in-class debate, a student or several students, depending on class size, should record the key issues on the class board. It may also be useful for a student to act as a recorder and make a hand-written collection of the issues on the board.

Research Projects:

The issues identified during in-class discussions serve as the basis for the research project. The students can relate these research issues to their lives and should be motivated to further their understanding of the human capital topic. The instructor can use Chapter II as a guide to assist the students in narrowing their topics before beginning the research. Have the students make presentations of the salient issues uncovered in their research. After all of the students make their presentations, the instructor should pull all of the competing issues together and illustrate the concrete principles highlighted in the summary section of Chapter II. If time permits, a quick review of the state rates-of-return studies might provide additional insight and interest into the human capital lessons.

Summarizing the Learning Process:

This real life example of rates-of-return analysis and human capital helps highlight how the economist uses research tools and theories to evaluate current public policy issues. A hands-on approach allows the student an opportunity to “do economics” and apply the material. More advanced classes can use the material in Chapter III and IV to review demographic census data and construct simple age-earning profiles.

Advanced Projects:

The use of demographic census material and regression analysis to construct age-earning profiles is most appropriate for students who have already had introductory statistics and introductory economics (micro and macroeconomics) courses. Public finance, economic and financial modeling, and econometric courses present excellent opportunities for students to pursue the reconstruction of the basic model outlined in Chapters III and IV. Graduate students may be able to use alternate modeling techniques to develop both social and private rates-of-return. Advanced students may be fully capable of using the alternate models discussed in Chapter II and developing private rates-of-return models for various degree programs.

Testing:

Testing subject mastery of the exploration in human capital and social rates-of-return studies is best handled in an active mode rather than standard multiple choice or essay tests. Specifically, the students should demonstrate the ability to apply human capital principles and arrive at a cogent and integrated discussion of the material. This application is best accomplished for undergraduate, or less advanced students, in the presentation format discussed in a prior section.

Model reconstruction and alternate model development is the most appropriate method of testing advanced students. This testing method not only assures that the

students understands the material in an integrated fashion, but students are also capable of applying advanced concepts into a working economic model.

Higher Education Planning:

Higher education spending at federal, state, and local levels exists in an increasingly competitive environment. The demand for government services continues to grow; however, the citizens have become more skeptical of government spending and less willing to pay additional taxes. The ability to provide a qualitative discussion of the benefits of higher education spending supported by a quantifiable estimate of these benefits is no longer a luxury but a necessity in order to ensure continuity in higher education funding.

State rates-of-return studies, such as this study, define the benefits that accrue for the citizens of Tennessee by funding higher education through their taxes. Additionally, this study may be refined and expanded, as discussed in the Areas for Further Study section in Chapter VI, to include school and program specific rates-of-return studies. These specific studies may provide a basis to determine the level of state funding that generates certain required rates-of-return.

Additionally, studies that balance private rates-of-return against social rates-of-return can serve as the basis for evaluating the overall level of state higher education subsidies relative to private funding of higher education. These models may be further refined to develop supply and demand curves for higher education in the state of Tennessee. Businesses typically use this type of analysis in making capital investment

decisions. The development of tools that assist public planners in allocating capital helps to create a more efficient public sector.

CHAPTER VI

SUMMARY AND CONCLUSION

The purpose of this study is to find an appropriate estimation method to determine the social rates-of-return associated with investment in higher education in the state of Tennessee. This rates-of-return study is developed using demographic census data, higher education expenditure data, actual tax collections, and developing estimates of future earnings, induced earnings, and future tax collections. The methods and estimating procedures are selected based on their ability to accurately estimate the desired parameters and develop meaningful rates-of-return.

Estimating Methodology:

The various components of the model fit together well to produce a realistic estimate of the rates-of-return associated with higher education in the state of Tennessee. The model combines estimating techniques from recent state level higher education rates-of-return studies with well-established methodology for measuring human capital investment.

These estimating techniques have been modified where necessary to fit the state of Tennessee's revenue system and higher education system characteristics. The various

estimating modules within the rates-of-return model are further enhanced to take advantage of research innovations, i.e., the expected worklife estimates and the Tennessee specific income multiplier.

The various state rates-of-return studies, while differing in methodology, timing, and application, overwhelmingly support the notion that higher education yields high returns on state subsidies for higher education. The findings of this study are consistent with the other state studies; however, in several instances a more conservative estimating approach is employed:

- Use of worklife estimates that consider reduced average worklives of individuals with higher levels of attained education.
- Use of MIRR instead of IRR cash-flow reinvestment assumptions.
- Use of Tennessee's current revenue system.
- Not including welfare enhancements such as quality of life, longer life expectancy, and increased leisure that are not directly measured by the market but add to the social value of higher education in the rates-of-return estimates.

The method used in developing the impact tax rate calculation implies that the 32.1 percent of the TPI (interest, dividends, rent, and transfer payments) will grow in direct proportion to earnings over the rates-of-return estimating period. Further, this methodology implies that these other items of TPI (32.1 percent) are to a large extent induced by earnings. The calculation of the impact tax rate is central to the estimation of rates-of-return for higher education.

Several issues that may affect tax rate calculations were considered; however, they are beyond the scope of this study. These issues pose the following questions:

- Are the elements in TPI which are not earnings actually induced by earnings?
- Are there effects on tax collection beyond the elements of TPI, such as tax collection on state tourism?
- Are there long-term structural shifts in relationships between elements of TPI and tax collection?

This study assumes that a long-term relationship between earnings, interest, dividends, and future collection of transfer payments do exist. Earnings are the base for investments that yield interest and dividends. Additionally, earnings are the basis for future social security payments which are the largest portion of transfer payments. Further research may lead to better tax rate measures.

Rates-of-Return Estimates:

The rates-of-return are estimated in both real and in nominal terms for the 1992 workforce entrants. These rates are segregated by the level of attained higher education and by gender. This study develops gender specific rates-of-return for analysis and comparison; however, combined rates-of-return should be used to develop higher education policy. The combined real rates-of-return are listed below (nominal rates are in parenthesis):

- Undergraduate 4.82 percent (8.57 percent).
- Graduate 6.32 percent (10.07 percent).

- Professional 5.78 percent (9.53 percent)
- Overall 5.03 percent (8.78 percent).

The major finding of this study is that the rates-of-return on higher education, for all levels beyond high school and for all genders, exceed alternate forms of investment that exhibit similar risk characteristics. The model estimates returns consistent with other state studies and the results are in harmony with mainstream human capital investment literature and studies.

Conclusion and Implications:

It is important to note that higher education rates-of-return research indicates that the findings of a study for one state, or at one point time period, should not be applied to other states or for other time periods. Rates-of-return models must be developed based on each state's demographic factors, economic situation, structure of the higher education system, and the characteristics of each state's revenue system.

An increasing body of knowledge is developing on social rates-of-return modeling associated with state higher education. A researcher must consider the full range of techniques available and adopt the data and models that are most appropriate.

Implications of this and other state-level rates-of-return studies are listed below:

- The studies demonstrate the need for increased state level demographic data and higher education longitudinal studies to support research.

- The studies increase information concerning tax revenue usage and improve economic efficiency by verifying that the state leadership employs state resources in the most appropriate manner.
- Misconceptions surrounding higher education expenditures are reduced.
- Higher education programs that yield the highest returns can be expanded, while lower returning programs may be reviewed for their effectiveness.
- Higher education planners can make long-term public investment decisions using models that maximize returns to the citizenry similar to methods employed by business in developing capital budgeting models to maximize capital investments.

State level social rates-of-return studies should be completed periodically to evaluate economic and education trends that affect higher education spending. These models should also be tied into the higher education planning process.

Recommendations for Future Studies:

Based on the results of this study some recommendations for future studies are suggested:

1. A longitudinal study of graduates from the state of Tennessee institutions of higher education that verifies state-specific earnings growth, migration patterns, and worklife patterns.

2. An attempt should be made to develop a study of social rates-of-return by degree programs compared against private rates-of-return by degree programs. A future study can be useful in determining the state funding or subsidy mix for different degree programs and can also form the basis for differential tuition levels by degree programs within the state.
3. An attempt should be made to include positive and negative externalities associated with higher education institutions in the rates-of return studies. The imputed costs that are typically not measured by the market should be included as costs and benefits to the state.
4. An attempt should be made to identify the disparities between male and female rates-of-return by level of attained education. Are the differentials the results of discrimination patterns, life-style characteristics, degree selection and market conditions, or a combination of these characteristics?

APPENDIX ONE

CALCULATION OF EDUCATION RELATED SALARIES AND ASSOCIATED TAX COLLECTIONS

<u>E & G Expenditure Category</u>	Actual 91-92	Salary ¹ Factor	State Funded Salary
Instruction	\$517,415,863	70.0%	\$362,191,104
Research	\$35,292,923	55.4%	\$19,552,279
Public Service	\$46,580,011	60.5%	\$28,180,907
Academic Support	\$95,330,024	54.1%	\$51,573,543
Student Services	\$84,783,954	48.7%	\$41,289,786
Institutional Support	\$108,602,982	62.3%	\$67,659,658
O & M of Plant	\$94,284,044	43.2%	\$40,730,707
Scholarships & Fellowships	<u>\$21,708,693</u>	100.0%	<u>\$21,708,693</u>
Total	<u>\$1,003,998,494</u>		<u>\$632,886,677</u>

<u>E & G Expenditure Category</u>	Tax ² Impact
Instruction	\$33,928,686
Research	\$1,831,583
Public Service	\$2,639,880
Academic Support	\$4,831,214
Student Services	\$3,867,870
Institutional Support	\$6,338,100
O & M of Plant	\$3,815,498
Scholarships & Fellowships	<u>\$2,033,588</u>
Total ³	<u>\$59,286,419</u>

¹ Table 10, Public, US Dept. of Education, NCES 92-347, State Higher Education Profile.

² Tax Impact is based on the calculation of 1992 tax collected as a percent of Adjusted Tennessee Personal Income which includes only earnings such as wage and salary disbursements, other labor income and proprietors' income (the rate equals 9.36762%) - see Appendix Two, Tax Impact Rate Calculation.

³ Only earnings related to higher attained education are estimated in this study. Other items in the TPI such as interest, dividends, rent, and transfer payments are assumed to expand in direct proportion to earnings.

APPENDIX TWO

TAX IMPACT RATE CALCULATION

<u>Class of Tax</u>	<u>1992¹</u>	<u>1992 as % of ATPI²</u>
Franchise	\$217,921,111.71	0.36177%
Excise	\$335,199,336.70	0.55647%
Income	\$92,793,314.47	0.15405%
Inheritance and Estate	\$34,096,230.64	0.05660%
Gasoline	\$505,388,427.16	0.83900%
Petroleum Special Tax	\$49,630,853.11	0.08239%
Tobacco	\$79,064,951.74	0.13126%
Beer	\$13,433,398.69	0.02230%
Motor Vehicle Reg.	\$149,476,571.47	0.24815%
Motor Vehicle Title	\$7,349,031.19	0.01220%
Mixed Drinks	\$23,374,908.64	0.03880%
Business	\$10,750,130.21	0.01785%
Privilege	\$99,966,524.29	0.16596%
Gross Receipts	\$167,084,502.04	0.27738%
Alcoholic Beverage	\$27,368,039.25	0.04543%
Sales	\$2,633,561,969.07	4.37199%
Services	\$229,543,810.32	0.38107%
Motor Vehicle Fuel	\$102,000,385.32	0.16933%
Severance	\$1,037,367.08	0.00172%
Coin Amusement	<u>\$325,550.71</u>	<u>0.00054%</u>
Subtotal State	\$4,779,366,413.81	7.93425%
Local Sales Tax ³	\$853,264,925.38	1.41651%
Local Services Tax	\$6,487,453.93	0.01077%
Mineral Tax	<u>\$3,665,637.75</u>	<u>0.00609%</u>
 Total	 <u>\$5,642,784,430.87</u>	 <u>9.36762%</u>

¹Personal Income For 1992 in the State of Tennessee \$88,584,000,000. Source: Tennessee Comprehensive Annual Financial Report - June 30, 1994. According to the Bureau of Economic Analysis (BEA) Regional Facts (Bearfacts) for Tennessee 1986-1996, earnings, dividends, and interest averaged about 68% of Total Personal Income; hence TPI is adjusted to 68 percent to adjust the impact tax rate to the appropriate basis for application of the multiplier in Appendix One. Adjusted TPI (earnings): \$88,584,000,000 * 0.68 = \$60,237,120,000.

² Tax collection data provided by the Tennessee Department of Revenue, as listed in the Comparative Statement of Collected Revenues for 1991-1993.

³ Since a significant portion of local government financing consists of state contributions, any short-fall in local revenue would require increased state funding of local government. Accordingly, local sales tax is included in the overall tax burden of the state citizenry.

APPENDIX THREE

TENNESSEE DEPARTMENT OF REVENUE 1992 TAX COLLECTIONS BY CATEGORY

<u>Class of Tax</u>	<u>January</u>	<u>February</u>	<u>March</u>
Franchise	\$10,963,922.01	\$7,274,458.98	\$46,560,904.73
Excise	\$34,860,850.20	\$15,890,992.40	\$27,023,294.14
Income	\$3,542,421.84	\$1,596,960.45	\$5,130,801.65
Inheritance and Estate	\$3,356,229.70	\$1,873,299.28	\$2,140,127.83
Gasoline	\$41,062,930.97	\$43,719,350.38	\$35,490,882.20
Petroleum Special Tax	\$3,936,673.23	\$4,149,536.28	\$3,316,343.60
Tobacco	\$6,163,494.54	\$5,818,300.45	\$6,438,948.66
Beer	\$943,279.67	\$1,027,816.20	\$957,527.45
Motor Vehicle Reg.	\$9,182,128.77	\$10,661,686.41	\$23,334,122.12
Motor Vehicle Title	\$533,022.74	\$515,107.81	\$585,980.38
Mixed Drinks	\$2,262,938.91	\$1,733,496.93	\$1,975,692.09
Business	\$235,908.86	\$103,714.74	\$347,125.16
Privilege	\$6,804,247.27	\$5,868,049.91	\$5,792,880.65
Gross Receipts	\$13,079,172.80	\$13,082,552.12	\$12,400,462.81
Alcoholic Beverage	\$3,264,066.80	\$1,854,547.32	\$1,940,199.73
Sales	\$236,302,537.29	\$184,683,343.58	\$189,333,127.70
Services	\$0	\$0	\$0
Motor Vehicle Fuel	\$8,052,098.18	\$8,755,749.37	\$5,569,040.42
Severance	\$91,290.01	\$89,625.61	\$87,598.98
Coin Amusement	\$9,975.00	\$6,825.00	\$175.00
Subtotal State	\$384,647,188.79	\$308,705,413.22	\$368,425,235.30
Local Sales Tax	\$83,171,003.02	\$61,136,503.06	\$63,155,168.79
Local Services Tax	\$0	\$0	\$0
Mineral Tax	\$143,583.18	\$122,957.22	\$116,054.81
Total	\$467,961,774.99	\$369,964,873.50	\$431,696,458.90

<u>Class of Tax</u>	<u>April</u>	<u>May</u>	<u>June</u>
Franchise	\$71,539,612.75	\$8,191,201.63	\$7,313,076.50
Excise	\$93,199,127.34	\$11,896,466.80	\$15,142,303.70
Income	\$75,701,462.85	\$370,551.57	\$381,236.96
Inheritance and Estate	\$8,135,003.01	\$1,409,017.02	\$4,008,072.27
Gasoline	\$41,226,053.37	\$44,466,089.48	\$51,254,945.71
Petroleum Special Tax	\$4,011,332.83	\$4,569,113.54	\$5,016,080.82
Tobacco	\$6,880,344.61	\$6,387,150.08	\$7,388,449.52
Beer	\$1,212,565.32	\$1,191,063.32	\$1,137,232.62
Motor Vehicle Reg.	\$26,802,168.94	\$18,668,468.17	\$11,641,976.41
Motor Vehicle Title	\$600,118.00	\$519,223.81	\$589,525.75
Mixed Drinks	\$1,878,299.63	\$1,788,731.33	\$2,134,175.70
Business	\$201,530.04	\$341,264.45	\$7,889,469.65
Privilege	\$8,186,754.23	\$12,896,648.39	\$14,046,220.21
Gross Receipts	\$12,820,266.34	\$13,593,499.78	\$12,502,038.65
Alcoholic Beverage	\$2,237,858.40	\$2,223,609.78	\$2,233,868.31
Sales	\$207,863,934.58	\$224,997,823.70	\$217,083,489.23
Services	\$0	\$0	\$0
Motor Vehicle Fuel	\$10,085,555.86	\$9,326,443.11	\$6,721,851.77
Severance	\$85,903.69	\$94,530.71	\$88,368.47
Coin Amusement	\$525.00	\$525.00	\$262.50
Subtotal State	\$572,668,416.79	\$362,931,421.67	\$366,572,644.75
Local Sales Tax	\$69,414,190.80	\$69,890,589.31	\$66,796,062.76
Local Services Tax	\$0	\$0	\$0
Mineral Tax	\$153,140.79	\$243,038.96	\$243,789.15
Total	\$642,235,748.38	\$433,065,049.94	\$433,612,496.66

<u>Class of Tax</u>	<u>July</u>	<u>August</u>	<u>September</u>
Franchise	\$8,271,047.01	\$7,034,477.32	\$13,901,867.96
Excise	\$54,392,080.84	\$13,938,884.77	\$12,340,231.11
Income	\$316,930.58	\$1,068,950.87	\$279,098.49
Inheritance and Estate	\$1,560,621.63	\$1,791,451.27	\$2,853,429.13
Gasoline	\$42,003,944.71	\$41,646,691.82	\$46,348,710.21
Petroleum Special Tax	\$4,045,919.56	\$4,013,592.61	\$4,518,347.00
Tobacco	\$6,910,271.26	\$6,539,202.41	\$6,806,408.98
Beer	\$1,321,162.64	\$1,256,075.94	\$1,164,363.54
Motor Vehicle Reg.	\$9,806,059.26	\$9,407,161.72	\$7,970,103.36
Motor Vehicle Title	\$681,578.52	\$667,761.41	\$726,786.73
Mixed Drinks	\$1,987,500.68	\$2,118,157.70	\$1,886,038.35
Business	\$683,096.70	\$200,480.56	\$228,206.22
Privilege	\$8,637,439.76	\$7,155,035.74	\$7,115,082.42
Gross Receipts	\$16,646,967.03	\$20,157,524.06	\$13,653,235.68
Alcoholic Beverage	\$2,392,480.32	\$2,141,630.08	\$2,054,035.87
Sales	\$249,592,778.35	\$228,532,927.21	\$222,682,411.83
Services	\$0	\$41,054,820.90	\$46,213,708.75
Motor Vehicle Fuel	\$9,960,274.85	\$8,840,297.55	\$7,334,912.88
Severance	\$92,937.20	\$79,179.16	\$81,881.56
Coin Amusement	\$275,152.50	\$16,273.21	\$12,425.00
Subtotal State	\$419,578,243.40	\$397,660,576.31	\$398,171,285.07
Local Sales Tax	\$77,578,241.78	\$73,924,762.91	\$70,762,874.31
Local Services Tax	\$0	\$0	\$1,671,447.42
Mineral Tax	\$273,737.76	\$1,356,341.08	\$267,777.96
Total	\$497,430,222.94	\$472,941,680.30	\$470,873,384.76

<u>Class of Tax</u>	<u>October</u>	<u>November</u>	<u>December</u>
Franchise	\$14,184,557.64	\$10,191,800.52	\$12,494,184.66
Excise	\$43,753,203.00	\$7,658,619.00	\$5,103,283.40
Income	\$1,445,979.52	\$36,922.50	\$2,921,997.19
Inheritance and Estate	\$1,850,659.47	\$1,914,121.75	\$3,204,198.28
Gasoline	\$36,354,180.09	\$40,222,641.00	\$41,592,007.22
Petroleum Special Tax	\$3,718,124.06	\$4,158,933.66	\$4,176,855.92
Tobacco	\$6,597,348.09	\$4,785,253.94	\$8,349,779.20
Beer	\$1,134,076.52	\$1,050,938.26	\$1,037,297.21
Motor Vehicle Reg.	\$7,700,182.62	\$6,875,631.26	\$7,426,882.43
Motor Vehicle Title	\$672,620.34	\$611,531.36	\$645,774.34
Mixed Drinks	\$1,808,058.90	\$1,942,029.89	\$1,859,788.53
Business	\$287,755.28	\$72,286.58	\$159,291.97
Privilege	\$8,507,400.20	\$7,741,875.66	\$7,214,889.85
Gross Receipts	\$13,523,161.01	\$13,158,117.88	\$12,467,503.88
Alcoholic Beverage	\$2,148,291.46	\$2,259,664.25	\$2,617,786.93
Sales	\$227,463,949.55	\$223,912,187.14	\$221,113,458.91
Services	\$49,573,985.44	\$47,308,114.64	\$45,393,180.59
Motor Vehicle Fuel	\$9,276,846.99	\$9,959,869.49	\$8,117,444.85
Severance	\$78,744.41	\$79,054.81	\$88,252.47
Coin Amusement	\$787.50	\$525.00	\$2,100.00
Subtotal State	\$430,079,912.09	\$383,940,118.59	\$385,985,957.83
Local Sales Tax	\$72,751,623.42	\$72,510,918.75	\$72,172,986.47
Local Services Tax	\$1,633,920.97	\$1,662,550.97	\$1,519,534.57
Mineral Tax	\$252,882.14	\$296,943.45	\$195,391.25
Total	\$504,718,338.62	\$458,410,531.76	\$459,873,870.12

<u>Class of Tax</u>	<u>Total</u>
Franchise	\$64,799,285.72
Excise	\$77,775,136.74
Income	\$10,270,183.94
Inheritance and Estate	\$7,369,656.81
Gasoline	\$120,273,163.55
Petroleum Special Tax	\$11,402,553.11
Tobacco	\$18,420,743.65
Beer	\$2,928,623.32
Motor Vehicle Reg.	\$43,177,937.30
Motor Vehicle Title	\$1,634,110.93
Mixed Drinks	\$5,972,127.93
Business	\$686,748.76
Privilege	\$18,465,177.83
Gross Receipts	\$38,562,187.73
Alcoholic Beverage	\$7,058,813.85
Sales	\$610,319,008.57
Services	\$-
Motor Vehicle Fuel	\$22,376,887.97
Severance	\$268,514.60
Coin Amusement	\$16,975.00
Subtotal State	<u>\$1,061,777,837.31</u>
Local Sales Tax	\$207,462,674.87
Local Services Tax	\$-
Mineral Tax	\$382,595.21
Total	<u><u>\$1,269,623,107.39</u></u>

APPENDIX FOUR

AGE EARNING PROFILES BY LEVEL OF ATTAINED EDUCATION BY GENDER (1989 VALUES)

Male Age Earning Profile in 1989 Dollars:

<u>Age</u>	<u>No</u> <u>College</u>	<u>Some</u> <u>College</u>	<u>Assoc.</u> <u>Tech.</u>	<u>Assoc</u> <u>Academic</u>
18	\$3,717	\$-	\$-	\$-
19	\$4,888	\$-	\$-	\$-
20	\$6,011	\$2,790	\$9,992	\$(1,019)
21	\$7,086	\$4,793	\$11,410	\$1,731
22	\$8,113	\$6,720	\$12,769	\$4,367
23	\$9,091	\$8,568	\$14,070	\$6,889
24	\$10,022	\$10,340	\$15,312	\$9,297
25	\$10,905	\$12,034	\$16,495	\$11,590
26	\$11,740	\$13,650	\$17,619	\$13,769
27	\$12,526	\$15,189	\$18,684	\$15,833
28	\$13,265	\$16,651	\$19,691	\$17,783
29	\$13,955	\$18,035	\$20,639	\$19,619
30	\$14,598	\$19,341	\$21,529	\$21,341
31	\$15,192	\$20,571	\$22,359	\$22,948
32	\$15,739	\$21,722	\$23,131	\$24,441
33	\$16,237	\$22,797	\$23,844	\$25,820
34	\$16,687	\$23,794	\$24,498	\$27,084
35	\$17,089	\$24,713	\$25,093	\$28,234
36	\$17,443	\$25,555	\$25,630	\$29,270
37	\$17,749	\$26,319	\$26,108	\$30,191
38	\$18,007	\$27,007	\$26,527	\$30,998
39	\$18,217	\$27,616	\$26,888	\$31,691
40	\$18,379	\$28,148	\$27,189	\$32,269
41	\$18,493	\$28,603	\$27,432	\$32,733
42	\$18,558	\$28,980	\$27,616	\$33,083
43	\$18,576	\$29,280	\$27,741	\$33,319
44	\$18,546	\$29,503	\$27,808	\$33,440
45	\$18,467	\$29,647	\$27,816	\$33,447
46	\$18,341	\$29,715	\$27,765	\$33,339
47	\$18,166	\$29,705	\$27,655	\$33,117
48	\$17,943	\$29,618	\$27,487	\$32,781
49	\$17,673	\$29,453	\$27,259	\$32,331
50	\$17,354	\$29,210	\$26,974	\$31,766
51	\$16,987	\$28,891	\$26,629	\$31,087
52	\$16,572	\$28,493	\$26,225	\$30,294
53	\$16,109	\$28,019	\$25,763	\$29,386
54	\$15,598	\$27,467	\$25,242	\$28,364
55	\$-	\$26,837	\$24,662	\$27,228
56	\$-	\$26,130	\$24,023	\$25,977
57	\$-	\$25,346	\$23,326	\$24,613
Total Earnings	\$544,039	\$861,249	\$880,900	\$930,452
Constant	-25,581.5	-53,548.6	-30,711	-80,032.5
Age	2060.21	3591.4	2622.76	5093.81
Age^2	-24.03	-38.7244	-29.3814	-57.1567

<u>Age</u>	<u>Bachelor's</u>	<u>Master's</u>	<u>Professional</u>	<u>Doctorate</u>
18	\$-	\$-	\$-	\$-
19	\$-	\$-	\$-	\$-
20	\$-	\$-	\$-	\$-
21	\$-	\$-	\$-	\$-
22	\$6,299	\$-	\$-	\$-
23	\$9,363	\$-	\$-	\$-
24	\$12,299	\$14,160	\$-	\$-
25	\$15,106	\$16,810	\$-	\$-
26	\$17,784	\$19,339	\$-	\$-
27	\$20,334	\$21,746	\$22,949	\$17,999
28	\$22,756	\$24,032	\$26,384	\$21,253
29	\$25,049	\$26,195	\$29,658	\$24,344
30	\$27,214	\$28,238	\$32,772	\$27,271
31	\$29,250	\$30,158	\$35,726	\$30,035
32	\$31,158	\$31,957	\$38,519	\$32,635
33	\$32,938	\$33,634	\$41,151	\$35,072
34	\$34,589	\$35,190	\$43,623	\$37,345
35	\$36,111	\$36,624	\$45,935	\$39,455
36	\$37,505	\$37,937	\$48,086	\$41,401
37	\$38,771	\$39,127	\$50,077	\$43,184
38	\$39,909	\$40,196	\$51,907	\$44,803
39	\$40,917	\$41,144	\$53,577	\$46,259
40	\$41,798	\$41,970	\$55,086	\$47,552
41	\$42,550	\$42,674	\$56,435	\$48,681
42	\$43,174	\$43,257	\$57,623	\$49,646
43	\$43,669	\$43,718	\$58,651	\$50,448
44	\$44,036	\$44,057	\$59,518	\$51,087
45	\$44,274	\$44,275	\$60,225	\$51,562
46	\$44,384	\$44,371	\$60,772	\$51,874
47	\$44,365	\$44,346	\$61,158	\$52,022
48	\$44,218	\$44,199	\$61,383	\$52,006
49	\$43,943	\$43,930	\$61,449	\$51,828
50	\$43,539	\$43,540	\$61,353	\$51,485
51	\$43,007	\$43,028	\$61,097	\$50,979
52	\$42,346	\$42,394	\$60,681	\$50,310
53	\$41,557	\$41,639	\$60,104	\$49,478
54	\$40,640	\$40,762	\$59,367	\$48,481
55	\$39,594	\$39,764	\$58,470	\$47,322
56	\$38,419	\$38,643	\$57,412	\$45,999
57	\$37,117	\$37,402	\$56,193	\$44,512
58	\$35,685	\$36,038	\$54,814	\$42,862
59	\$34,126	\$34,553	\$53,274	\$41,048
60	\$32,438	\$32,947	\$51,574	\$39,071
61	\$-	\$31,219	\$49,714	\$36,931
Total Earnings	\$1,342,231	\$1,375,214	\$1,796,717	\$1,496,241
Constant	-93,596.5	-85,935.8	-130,446	-131,655
Age	5,953.45	5,630.18	7,847.54	7,749.63
Age^2	-64.2147	-60.8134	-80.2311	-81.7365

Female Age Earning Profile in 1989 Dollars:

Age	No College	Some College	Assoc. Tech.	Assoc Academic
18	\$3,669	\$-	\$-	\$-
19	\$4,088	\$-	\$-	\$-
20	\$4,489	\$6,181	\$9,699	\$9,110
21	\$4,870	\$6,826	\$10,256	\$9,834
22	\$5,232	\$7,440	\$10,786	\$10,520
23	\$5,575	\$8,023	\$11,288	\$11,170
24	\$5,898	\$8,576	\$11,762	\$11,781
25	\$6,201	\$9,098	\$12,208	\$12,355
26	\$6,485	\$9,589	\$12,626	\$12,892
27	\$6,750	\$10,050	\$13,017	\$13,391
28	\$6,996	\$10,480	\$13,379	\$13,853
29	\$7,222	\$10,880	\$13,714	\$14,277
30	\$7,428	\$11,248	\$14,021	\$14,663
31	\$7,616	\$11,587	\$14,300	\$15,012
32	\$7,783	\$11,894	\$14,551	\$15,324
33	\$7,932	\$12,171	\$14,775	\$15,598
34	\$8,061	\$12,417	\$14,970	\$15,834
35	\$8,171	\$12,632	\$15,138	\$16,033
36	\$8,261	\$12,817	\$15,278	\$16,195
37	\$8,332	\$12,971	\$15,390	\$16,319
38	\$8,383	\$13,095	\$15,474	\$16,405
39	\$8,415	\$13,188	\$15,531	\$16,454
40	\$8,428	\$13,250	\$15,559	\$16,465
41	\$8,421	\$13,282	\$15,560	\$16,439
42	\$8,395	\$13,283	\$15,533	\$16,375
43	\$8,350	\$13,253	\$15,478	\$16,274
44	\$8,285	\$13,192	\$15,395	\$16,136
45	\$8,201	\$13,101	\$15,284	\$15,959
46	\$8,097	\$12,980	\$15,146	\$15,746
47	\$-	\$12,827	\$14,980	\$15,494
48	\$-	\$12,644	\$14,786	\$15,206
49	\$-	\$12,431	\$14,564	\$14,879
50	\$-	\$12,186	\$14,314	\$14,515
61	\$-	\$11,911	\$14,036	\$14,114
52	\$-	\$11,606	\$13,731	\$13,675
53	\$-	\$11,269	\$13,397	\$13,199
Total Earnings	\$206,032	\$388,380	\$475,927	\$491,496
Constant	-7,207.86	-13,149.3	-7,296.54	-13,253.1
Age	778.799	1,273.08	1,128.16	1,493.31
Age^2	-9.69757	-15.3274	-13.9191	-18.7588

<u>Age</u>	<u>Bachelor's</u>	<u>Master's</u>	<u>Professional</u>	<u>Doctorate</u>
18	\$-	\$-	\$-	\$-
19	\$-	\$-	\$-	\$-
20	\$-	\$-	\$-	\$-
21	\$-	\$-	\$-	\$-
22	\$14,392	\$-	\$-	\$-
23	\$14,839	\$-	\$-	\$-
24	\$15,256	\$14,356	\$-	\$-
25	\$15,642	\$15,263	\$-	\$-
26	\$15,999	\$16,125	\$-	\$-
27	\$16,325	\$16,943	\$21,031	\$17,122
28	\$16,621	\$17,717	\$21,713	\$18,254
29	\$16,886	\$18,447	\$22,354	\$19,340
30	\$17,122	\$19,132	\$22,955	\$20,382
31	\$17,327	\$19,772	\$23,514	\$21,378
32	\$17,502	\$20,368	\$24,033	\$22,329
33	\$17,647	\$20,920	\$24,511	\$23,234
34	\$17,761	\$21,427	\$24,948	\$24,094
35	\$17,846	\$21,890	\$25,345	\$24,909
36	\$17,900	\$22,309	\$25,700	\$25,678
37	\$17,924	\$22,683	\$26,015	\$26,402
38	\$17,918	\$23,013	\$26,290	\$27,081
39	\$17,881	\$23,298	\$26,523	\$27,715
40	\$17,814	\$23,539	\$26,716	\$28,303
41	\$17,718	\$23,735	\$26,868	\$28,846
42	\$17,590	\$23,888	\$26,979	\$29,343
43	\$17,433	\$23,995	\$27,049	\$29,795
44	\$17,246	\$24,059	\$27,079	\$30,202
45	\$17,028	\$24,078	\$27,068	\$30,564
46	\$16,780	\$24,052	\$27,016	\$30,880
47	\$16,502	\$23,982	\$26,923	\$31,151
48	\$16,193	\$23,868	\$26,790	\$31,377
49	\$15,855	\$23,709	\$26,615	\$31,557
50	\$15,486	\$23,506	\$26,401	\$31,692
51	\$15,087	\$23,258	\$26,145	\$31,781
52	\$14,658	\$22,967	\$25,848	\$31,826
53	\$14,198	\$22,630	\$25,511	\$31,825
54	\$13,709	\$22,250	\$25,133	\$31,778
55	\$13,189	\$21,824	\$24,714	\$31,687
56	\$12,639	\$21,355	\$24,255	\$31,550
57		\$20,841	\$23,754	\$31,367
Total Earnings	\$571,909	\$731,199	\$785,795	\$853,440
Constant	-3,084.6	-20,732.5	-12,787	-30,574
Age	1,126.74	1,994.85	1,802.84	2,378.34
Age^2	-15.1066	-22.2016	-20.3818	-22.6605

APPENDIX FIVE

AGE EARNING PROFILES BY LEVEL OF ATTAINED EDUCATION BY GENDER (1992 VALUES)

Male Age Earning Profile in 1992 Dollars:

<u>Age</u>	<u>No</u> <u>College</u>	<u>Some</u> <u>College</u>	<u>Assoc.</u> <u>Tech.</u>	<u>Assoc</u> <u>Academic</u>
18	\$4,228	\$-	\$-	\$-
19	\$5,561	\$-	\$-	\$-
20	\$6,838	\$3,174	\$11,367	\$(1,159)
21	\$8,061	\$5,453	\$12,981	\$1,970
22	\$9,230	\$7,645	\$14,527	\$4,969
23	\$10,343	\$9,748	\$16,007	\$7,838
24	\$11,402	\$11,764	\$17,420	\$10,577
25	\$12,407	\$13,691	\$18,766	\$13,186
26	\$13,356	\$15,530	\$20,045	\$15,665
27	\$14,251	\$17,281	\$21,257	\$18,013
28	\$15,091	\$18,943	\$22,403	\$20,232
29	\$15,877	\$20,518	\$23,481	\$22,321
30	\$16,608	\$22,005	\$24,493	\$24,279
31	\$17,284	\$23,403	\$25,438	\$26,108
32	\$17,906	\$24,714	\$26,316	\$27,806
33	\$18,473	\$25,936	\$27,127	\$29,375
34	\$18,985	\$27,070	\$27,871	\$30,813
35	\$19,442	\$28,116	\$28,549	\$32,122
36	\$19,845	\$29,074	\$29,159	\$33,300
37	\$20,193	\$29,944	\$29,703	\$34,348
38	\$20,487	\$30,725	\$30,180	\$35,266
39	\$20,726	\$31,419	\$30,590	\$36,055
40	\$20,910	\$32,024	\$30,933	\$36,713
41	\$21,039	\$32,542	\$31,209	\$37,241
42	\$21,114	\$32,971	\$31,419	\$37,639
43	\$21,134	\$33,312	\$31,561	\$37,907
44	\$21,099	\$33,565	\$31,637	\$38,044
45	\$21,010	\$33,730	\$31,646	\$38,052
46	\$20,866	\$33,807	\$31,588	\$37,930
47	\$20,668	\$33,795	\$31,463	\$37,678
48	\$20,414	\$33,696	\$31,272	\$37,295
49	\$20,106	\$33,508	\$31,013	\$36,783
50	\$19,744	\$33,233	\$30,688	\$36,140
51	\$19,326	\$32,869	\$30,296	\$35,368
52	\$18,854	\$32,417	\$29,836	\$34,465
53	\$18,328	\$31,877	\$29,310	\$33,433
54	\$17,746	\$31,249	\$28,718	\$32,270
55	\$-	\$30,533	\$28,058	\$30,977
56	\$-	\$29,728	\$27,332	\$29,555
57	\$-	\$28,836	\$26,538	\$28,002
Total Earnings	\$618,953	\$979,843	\$1,002,199	\$1,058,575

<u>Age</u>	<u>Bachelor's</u>	<u>Master's</u>	<u>Professional</u>	<u>Doctorate</u>
18	\$-	\$-	\$-	\$-
19	\$-	\$-	\$-	\$-
20	\$-	\$-	\$-	\$-
21	\$-	\$-	\$-	\$-
22	\$7,167	\$-	\$-	\$-
23	\$10,653	\$-	\$-	\$-
24	\$13,992	\$16,110	\$-	\$-
25	\$17,186	\$19,125	\$-	\$-
26	\$20,233	\$22,002	\$-	\$-
27	\$23,134	\$24,741	\$26,109	\$20,478
28	\$25,889	\$27,341	\$30,017	\$24,180
29	\$28,498	\$29,802	\$33,742	\$27,696
30	\$30,961	\$32,126	\$37,285	\$31,026
31	\$33,278	\$34,311	\$40,645	\$34,171
32	\$35,449	\$36,358	\$43,823	\$37,129
33	\$37,473	\$38,266	\$46,818	\$39,901
34	\$39,351	\$40,036	\$49,630	\$42,487
35	\$41,084	\$41,667	\$52,260	\$44,888
36	\$42,670	\$43,160	\$54,707	\$47,102
37	\$44,110	\$44,515	\$56,972	\$49,130
38	\$45,404	\$45,732	\$59,054	\$50,973
39	\$46,552	\$46,810	\$60,954	\$52,629
40	\$47,554	\$47,749	\$62,671	\$54,100
41	\$48,409	\$48,550	\$64,206	\$55,384
42	\$49,119	\$49,213	\$65,558	\$56,483
43	\$49,682	\$49,738	\$66,727	\$57,395
44	\$50,099	\$50,124	\$67,714	\$58,122
45	\$50,371	\$50,372	\$68,518	\$58,662
46	\$50,496	\$50,481	\$69,140	\$59,017
47	\$50,474	\$50,452	\$69,579	\$59,185
48	\$50,307	\$50,285	\$69,836	\$59,168
49	\$49,994	\$49,979	\$69,910	\$58,964
50	\$49,535	\$49,535	\$69,802	\$58,575
51	\$48,929	\$48,953	\$69,511	\$57,999
52	\$48,177	\$48,232	\$69,037	\$57,238
53	\$47,280	\$47,373	\$68,381	\$56,291
54	\$46,236	\$46,375	\$67,542	\$55,157
55	\$45,046	\$45,239	\$66,521	\$53,838
56	\$43,710	\$43,965	\$65,317	\$52,333
57	\$42,228	\$42,552	\$63,931	\$50,641
58	\$40,599	\$41,001	\$62,362	\$48,764
59	\$38,825	\$39,311	\$60,610	\$46,701
60	\$36,904	\$37,484	\$58,676	\$44,452
61	\$-	\$35,517	\$56,560	\$42,016
Total Earnings	\$1,527,056	\$1,564,581	\$2,044,125	\$1,702,273

Female Age Earning Profile in 1992 Dollars:

<u>Age</u>	<u>No</u> <u>College</u>	<u>Some</u> <u>College</u>	<u>Assoc.</u> <u>Tech.</u>	<u>Assoc</u> <u>Academic</u>
18	\$4,174	\$-	\$-	\$-
19	\$4,651	\$-	\$-	\$-
20	\$5,107	\$7,033	\$11,035	\$10,364
21	\$5,541	\$7,766	\$11,669	\$11,188
22	\$5,953	\$8,464	\$12,271	\$11,969
23	\$6,342	\$9,128	\$12,842	\$12,708
24	\$6,710	\$9,757	\$13,382	\$13,404
25	\$7,055	\$10,351	\$13,889	\$14,057
26	\$7,378	\$10,910	\$14,365	\$14,667
27	\$7,680	\$11,434	\$14,809	\$15,235
28	\$7,959	\$11,923	\$15,222	\$15,760
29	\$8,216	\$12,378	\$15,603	\$16,243
30	\$8,451	\$12,797	\$15,952	\$16,682
31	\$8,664	\$13,182	\$16,269	\$17,079
32	\$8,855	\$13,532	\$16,555	\$17,434
33	\$9,024	\$13,847	\$16,809	\$17,746
34	\$9,171	\$14,127	\$17,032	\$18,015
35	\$9,296	\$14,372	\$17,223	\$18,241
36	\$9,398	\$14,582	\$17,382	\$18,425
37	\$9,479	\$14,758	\$17,509	\$18,566
38	\$9,538	\$14,898	\$17,605	\$18,664
39	\$9,574	\$15,004	\$17,669	\$18,720
40	\$9,589	\$15,075	\$17,702	\$18,732
41	\$9,581	\$15,110	\$17,703	\$18,703
42	\$9,551	\$15,112	\$17,672	\$18,630
43	\$9,499	\$15,078	\$17,609	\$18,515
44	\$9,426	\$15,009	\$17,515	\$18,357
45	\$9,330	\$14,905	\$17,389	\$18,157
46	\$9,212	\$14,767	\$17,232	\$17,914
47	\$-	\$14,594	\$17,042	\$17,628
48	\$-	\$14,385	\$16,822	\$17,299
49	\$-	\$14,412	\$16,569	\$16,928
50	\$-	\$13,864	\$16,285	\$16,514
51	\$-	\$13,551	\$15,969	\$16,058
52	\$-	\$13,204	\$15,621	\$15,558
53	\$-	\$12,821	\$15,242	\$15,016
Total Earnings	\$234,403	\$441,859	\$541,463	\$559,175

<u>Age</u>	<u>Bachelor's</u>	<u>Master's</u>	<u>Professional</u>	<u>Doctorate</u>
18	\$-	\$-	\$-	\$-
19	\$-	\$-	\$-	\$-
20	\$-	\$-	\$-	\$-
21	\$-	\$-	\$-	\$-
22	\$16,374	\$-	\$-	\$-
23	\$16,882	\$-	\$-	\$-
24	\$17,356	\$16,333	\$-	\$-
25	\$17,796	\$17,364	\$-	\$-
26	\$18,202	\$18,346	\$-	\$-
27	\$18,573	\$19,277	\$23,927	\$19,479
28	\$18,909	\$20,157	\$24,703	\$20,767
29	\$19,211	\$20,987	\$25,432	\$22,004
30	\$19,479	\$21,766	\$26,115	\$23,188
31	\$19,713	\$22,495	\$26,752	\$24,322
32	\$19,912	\$23,173	\$27,342	\$25,403
33	\$20,077	\$23,801	\$27,886	\$26,433
34	\$20,207	\$24,378	\$28,384	\$27,412
35	\$20,303	\$24,905	\$28,835	\$28,339
36	\$20,365	\$25,381	\$29,239	\$29,214
37	\$20,392	\$25,806	\$29,598	\$30,038
38	\$20,385	\$26,182	\$29,910	\$30,810
39	\$20,343	\$26,506	\$30,175	\$31,531
40	\$20,267	\$26,780	\$30,394	\$32,200
41	\$20,157	\$27,004	\$30,567	\$32,818
42	\$20,013	\$27,177	\$30,694	\$33,384
43	\$19,834	\$27,299	\$30,774	\$33,898
44	\$19,620	\$27,371	\$30,808	\$34,361
45	\$19,373	\$27,393	\$30,795	\$34,772
46	\$19,090	\$27,364	\$30,736	\$35,132
47	\$18,774	\$27,284	\$30,630	\$35,440
48	\$18,423	\$27,154	\$30,479	\$35,697
49	\$18,038	\$26,974	\$30,280	\$35,902
50	\$17,618	\$26,743	\$30,036	\$36,056
51	\$17,164	\$26,461	\$29,745	\$36,158
52	\$16,676	\$26,129	\$29,408	\$36,208
53	\$16,153	\$25,746	\$29,024	\$36,207
54	\$15,596	\$25,313	\$28,594	\$36,154
55	\$15,005	\$24,830	\$28,117	\$36,050
56	\$14,379	\$24,295	\$27,595	\$35,894
57	\$-	\$23,711	\$27,025	\$35,687
Total Earnings	\$650,661	\$831,885	\$894,000	\$970,959

APPENDIX SIX

DIFFERENTIAL EARNINGS BY LEVEL OF ATTAINED EDUCATION BY GENDER SUMMARY (1992 VALUES)

Males:

<u>Education Level</u>	<u>Age Range¹</u>	<u>Total Amount</u>
Some College	18-57	\$360,890
Associate - Technical	18-57	\$383,246
Associate - Academic	18-57	\$439,622
Bachelor's	18-60	\$908,103
Master's	18-61	\$945,627
Professional	18-61	\$1,425,172
Doctorate	18-61	\$1,083,320

Females:

<u>Education Level</u>	<u>Age Range</u>	<u>Total Amount</u>
Some College	18-53	\$207,457
Associate - Technical	18-53	\$307,059
Associate - Academic	18-53	\$324,773
Bachelor's	18-56	\$416,255
Master's	18-57	\$597,481
Professional	18-57	\$659,596
Doctorate	18-57	\$736,556

¹ The age range includes negative differential incomes (earnings for the specific level of attained education less high school earnings) for the periods of time when the individual is pursuing education.

APPENDIX SEVEN

**DIFFERENTIAL AND INDUCED EARNINGS SUMMARY
(1992 VALUES)**

Males:

<u>Education Level</u>	<u>Age Range</u>	<u>Total Amount¹</u>
Some College	18-57	\$515.351
Associate - Technical	18-57	\$547.275
Associate - Academic	18-57	\$627.780
Bachelor's	18-60	\$1,296.771
Master's	18-61	\$1,350.356
Professional	18-61	\$2,035.145
Doctorate	18-61	\$1,546.981

Females:

<u>Education Level</u>	<u>Age Range</u>	<u>Total Amount</u>
Some College	18-53	\$296.249
Associate - Technical	18-53	\$438.480
Associate - Academic	18-53	\$463.776
Bachelor's	18-56	\$594.412
Master's	18-57	\$853.203
Professional	18-57	\$941.903
Doctorate	18-57	\$1,051.802

¹ Total earnings include differential earnings (earnings for the specific level of attained education less high school earnings) multiplied by the 1.428 income multiplier discussed in Chapter III.

APPENDIX EIGHT

TOTAL TAX COLLECTION SUMMARY (PER INDIVIDUAL IN 1992 VALUES)

Males:

<u>Education Level</u>	<u>Age Range</u>	<u>Total Amount</u>
Some College	18-57	\$48,276
Associate - Technical	18-57	\$51,267
Associate - Academic	18-57	\$58,808
Bachelor's	18-60	\$121,477
Master's	18-61	\$126,496
Professional	18-61	\$190,645
Doctorate	18-61	\$144,915

Females:

<u>Education Level</u>	<u>Age Range</u>	<u>Total Amount</u>
Some College	18-53	\$27,751
Associate - Technical	18-53	\$41,075
Associate - Academic	18-53	\$43,445
Bachelor's	18-56	\$55,682
Master's	18-57	\$79,925
Professional	18-57	\$88,234
Doctorate	18-57	\$98,529

APPENDIX NINE

REAL RATES-OF-RETURN CALCULATIONS (1992 VALUES)

Males:

<u>Age</u>	<u>Time Period</u>	<u>Some College</u>	<u>Assoc Tech</u>	<u>Assoc Academic</u>	<u>Bachelor's</u>
	0	\$(112,091,650)	\$(7,450,104)	\$(7,450,104)	\$(93,172,041)
18	1	\$(7,706,036)	\$(513,585)	\$(513,585)	\$(2,532,290)
19	2	\$(10,134,232)	\$(675,417)	\$(675,417)	\$(3,330,223)
20	3	\$(6,678,650)	\$550,119	\$(971,419)	\$(4,095,410)
21	4	\$(4,753,013)	\$597,537	\$(739,898)	\$(4,827,851)
22	5	\$(2,888,311)	\$643,477	\$(517,532)	\$(1,235,372)
23	6	\$(1,084,545)	\$687,937	\$(304,321)	\$185,201
24	7	\$658,285	\$730,918	\$(100,267)	\$1,551,014
25	8	\$2,340,179	\$772,420	\$94,633	\$2,862,067
26	9	\$3,961,138	\$812,444	\$280,377	\$4,118,360
27	10	\$5,521,161	\$850,988	\$456,966	\$5,319,893
28	11	\$7,020,249	\$888,053	\$624,399	\$6,466,666
29	12	\$8,458,400	\$923,639	\$782,677	\$7,558,679
30	13	\$9,835,617	\$957,747	\$931,799	\$8,595,932
31	14	\$11,151,897	\$990,375	\$1,071,766	\$9,578,425
32	15	\$12,407,242	\$1,021,524	\$1,202,578	\$10,506,158
33	16	\$13,601,651	\$1,051,195	\$1,324,234	\$11,379,132
34	17	\$14,735,124	\$1,079,386	\$1,436,734	\$12,197,345
35	18	\$15,807,661	\$1,106,098	\$1,540,079	\$12,960,798
36	19	\$16,819,263	\$1,131,331	\$1,634,269	\$13,669,492
37	20	\$17,769,930	\$1,155,086	\$1,719,303	\$14,323,425
38	21	\$18,659,660	\$1,177,361	\$1,795,182	\$14,922,599
39	22	\$19,488,455	\$1,198,157	\$1,861,905	\$15,467,012
40	23	\$20,256,314	\$1,217,474	\$1,919,473	\$15,956,666
41	24	\$20,963,238	\$1,235,313	\$1,967,886	\$16,391,560
42	25	\$21,609,225	\$1,251,672	\$2,007,143	\$16,771,693
43	26	\$22,194,278	\$1,266,552	\$2,037,244	\$17,097,067
44	27	\$22,718,394	\$1,279,953	\$2,058,191	\$17,367,681
45	28	\$23,181,575	\$1,291,876	\$2,069,981	\$17,583,535
46	29	\$23,583,820	\$1,302,319	\$2,072,617	\$17,744,629
47	30	\$23,925,129	\$1,311,283	\$2,066,097	\$17,850,963
48	31	\$24,205,503	\$1,318,768	\$2,050,421	\$17,902,537
49	32	\$24,424,941	\$1,324,775	\$2,025,590	\$17,899,351
50	33	\$24,583,443	\$1,329,302	\$1,991,603	\$17,841,405
51	34	\$24,681,010	\$1,332,350	\$1,948,462	\$17,728,699
52	35	\$24,717,641	\$1,333,919	\$1,896,164	\$17,561,233
53	36	\$24,693,336	\$1,334,009	\$1,834,711	\$17,339,008
54	37	\$24,608,095	\$1,332,621	\$1,764,103	\$17,062,022
55	38	\$55,644,890	\$3,408,007	\$3,762,594	\$26,977,352
56	39	\$54,178,956	\$3,319,764	\$3,589,778	\$26,177,183
57	40	\$52,552,437	\$3,223,400	\$3,401,165	\$25,289,509
58	41	\$-	\$-	\$-	\$24,314,328
59	42	\$-	\$-	\$-	\$23,251,642
60	43	\$-	\$-	\$-	\$22,101,450
61	44	\$-	\$-	\$-	\$-

IRR	6.20%	8.76%	6.90%	6.54%
MIRR	5.21%	5.94%	5.51%	5.27%
NPV	\$108,975,030	\$11,553,205	\$10,695,676	\$95,855,644
NPV/WFE ¹	\$7,999	\$3,181	\$2,945	\$21,411

¹ NPV expressed on a per workforce entrant basis.

Age	Time Period	Master's	Professional	Doctorate	Total
18	0	\$(11,820,168)	\$(6,940,935)	\$(4,200,712)	\$(243,125,713)
19	1	\$(813,365)	\$(236,996)	\$(144,234)	\$(12,460,090)
20	2	\$(1,069,658)	\$(311,674)	\$(189,682)	\$(16,386,304)
21	3	\$(1,315,434)	\$(383,287)	\$(233,265)	\$(13,127,347)
22	4	\$(1,550,692)	\$(451,836)	\$(274,984)	\$(12,000,736)
23	5	\$(1,775,433)	\$(517,320)	\$(314,837)	\$(6,605,327)
24	6	\$(1,989,655)	\$(579,739)	\$(352,825)	\$(3,437,948)
25	7	\$905,540	\$(639,094)	\$(388,948)	\$2,717,448
26	8	\$1,292,373	\$(695,384)	\$(423,205)	\$6,243,083
27	9	\$1,663,107	\$(748,610)	\$(455,598)	\$9,631,218
28	10	\$2,017,740	\$664,636	\$212,391	\$15,043,775
29	11	\$2,356,273	\$836,571	\$310,015	\$18,502,226
30	12	\$2,678,707	\$1,001,337	\$403,161	\$21,806,601
31	13	\$2,985,040	\$1,158,936	\$491,828	\$24,956,899
32	14	\$3,275,274	\$1,309,368	\$576,016	\$27,953,121
33	15	\$3,549,407	\$1,452,632	\$655,725	\$30,795,266
34	16	\$3,807,441	\$1,588,728	\$730,955	\$33,483,334
35	17	\$4,049,374	\$1,717,657	\$801,706	\$36,017,325
36	18	\$4,275,208	\$1,839,418	\$867,978	\$38,397,240
37	19	\$4,484,941	\$1,954,011	\$929,771	\$40,623,078
38	20	\$4,678,574	\$2,061,437	\$987,085	\$42,694,840
39	21	\$4,856,108	\$2,161,695	\$1,039,920	\$44,612,525
40	22	\$5,017,541	\$2,254,786	\$1,088,276	\$46,376,133
41	23	\$5,162,875	\$2,340,709	\$1,132,153	\$47,985,664
42	24	\$5,292,108	\$2,419,465	\$1,171,551	\$49,441,119
43	25	\$5,405,241	\$2,491,052	\$1,206,470	\$50,742,497
44	26	\$5,502,275	\$2,555,473	\$1,236,910	\$51,889,798
45	27	\$5,583,208	\$2,612,725	\$1,262,871	\$52,883,023
46	28	\$5,648,041	\$2,662,810	\$1,284,353	\$53,722,171
47	29	\$5,696,775	\$2,705,728	\$1,301,356	\$54,407,242
48	30	\$5,729,408	\$2,741,477	\$1,313,880	\$54,938,237
49	31	\$5,745,942	\$2,770,060	\$1,321,925	\$55,315,155
50	32	\$5,746,375	\$2,791,474	\$1,325,491	\$55,537,996
51	33	\$5,730,708	\$2,805,721	\$1,324,578	\$55,606,761
52	34	\$5,698,942	\$2,812,801	\$1,319,186	\$55,521,449
53	35	\$5,651,075	\$2,812,712	\$1,309,315	\$55,282,060
54	36	\$5,587,108	\$2,805,457	\$1,294,966	\$54,888,595
55	37	\$5,507,042	\$2,791,033	\$1,276,137	\$54,341,053
56	38	\$8,702,207	\$3,728,460	\$1,836,480	\$104,059,991
57	39	\$8,457,073	\$3,660,987	\$1,785,131	\$101,168,873
58	40	\$8,185,321	\$3,583,282	\$1,727,439	\$97,962,553
59	41	\$7,886,951	\$3,495,344	\$1,663,403	\$97,360,027
60	42	\$7,561,964	\$3,397,174	\$1,593,022	\$95,803,802
61	43	\$7,210,358	\$3,288,772	\$1,516,297	\$94,116,878
61	44	\$6,832,135	\$3,170,138	\$1,433,229	\$91,435,501
IRR		10.16%	8.39%	7.07%	6.81%
MIRR		6.82%	6.13%	5.52%	5.38%
NPV		\$49,702,753	\$18,764,628	\$7,281,405	\$302,828,341
NPV/WFE		\$34,564	\$44,784	\$28,555	\$13,747

Females:

<u>Age</u>	<u>Time Period</u>	<u>Some College</u>	<u>Assoc Tech</u>	<u>Assoc Academic</u>	<u>Bachelor's</u>
	0	\$(150,418,069)	\$(12,849,907)	\$(12,849,907)	\$(112,052,718)
18	1	\$(10,208,393)	\$(874,383)	\$(874,383)	\$(3,006,738)
19	2	\$(11,374,996)	\$(974,306)	\$(974,306)	\$(3,350,345)
20	3	\$4,707,991	\$1,241,607	\$1,101,253	\$(3,678,824)
21	4	\$5,441,704	\$1,283,713	\$1,182,952	\$(3,991,456)
22	5	\$6,143,623	\$1,323,724	\$1,260,461	\$7,506,761
23	6	\$6,813,748	\$1,361,641	\$1,333,570	\$7,592,482
24	7	\$7,452,078	\$1,397,672	\$1,402,281	\$7,669,560
25	8	\$8,061,060	\$1,431,608	\$1,466,801	\$7,737,273
26	9	\$8,638,247	\$1,463,659	\$1,526,923	\$7,796,341
27	10	\$9,181,195	\$1,493,406	\$1,582,646	\$7,846,766
28	11	\$9,694,794	\$1,521,477	\$1,634,179	\$7,887,826
29	12	\$10,179,044	\$1,547,243	\$1,681,522	\$7,920,241
30	13	\$10,629,055	\$1,571,334	\$1,724,256	\$7,944,013
31	14	\$11,049,717	\$1,593,120	\$1,762,801	\$7,959,140
32	15	\$11,438,585	\$1,613,021	\$1,797,157	\$7,964,903
33	16	\$11,795,659	\$1,630,827	\$1,827,113	\$7,962,022
34	17	\$12,120,938	\$1,646,748	\$1,852,670	\$7,949,776
35	18	\$12,414,423	\$1,660,573	\$1,873,827	\$7,928,886
36	19	\$12,678,560	\$1,672,305	\$1,890,795	\$7,899,351
37	20	\$12,910,902	\$1,682,150	\$1,903,574	\$7,861,173
38	21	\$13,111,450	\$1,690,111	\$1,911,744	\$7,813,630
39	22	\$13,280,204	\$1,695,767	\$1,915,724	\$7,757,442
40	23	\$13,417,164	\$1,699,537	\$1,915,515	\$7,692,611
41	24	\$13,524,775	\$1,701,423	\$1,910,906	\$7,618,415
42	25	\$13,598,147	\$1,701,213	\$1,901,898	\$7,535,575
43	26	\$13,642,170	\$1,698,909	\$1,888,701	\$7,444,090
44	27	\$13,654,398	\$1,694,510	\$1,871,104	\$7,343,962
45	28	\$13,637,278	\$1,688,225	\$1,849,108	\$7,234,469
46	29	\$13,585,918	\$1,680,055	\$1,822,923	\$7,116,331
47	30	\$35,692,689	\$3,570,013	\$3,692,770	\$13,523,839
48	31	\$35,181,536	\$3,523,927	\$3,623,850	\$13,270,996
49	32	\$34,587,229	\$3,470,927	\$3,546,132	\$12,993,662
50	33	\$33,907,321	\$3,411,434	\$3,459,406	\$12,691,115
51	34	\$33,141,814	\$3,345,237	\$3,363,881	\$12,364,077
52	35	\$32,293,153	\$3,272,337	\$3,259,140	\$12,012,546
53	36	\$31,356,446	\$3,192,943	\$3,145,600	\$11,635,803
54	37	\$-	\$-	\$-	\$11,234,569
55	38	\$-	\$-	\$-	\$10,808,842
56	39	\$-	\$-	\$-	\$10,357,904
IRR		5.23%	8.68%	8.99%	4.44%
MIRR		4.50%	5.73%	5.86%	4.08%
NPV		\$56,297,948	\$16,337,987	\$17,994,358	\$16,620,131
NPV/WFE		\$3,079	\$10,433	\$11,491	\$3,086

	<u>Time</u>	<u>Master's</u>	<u>Professional</u>	<u>Doctorate</u>	<u>Total</u>
<u>Age</u>	<u>Period</u>				
	0	\$(17,656,559)	\$(4,182,358)	\$(3,029,428)	\$(313,038,945)
18	1	\$(1,199,345)	\$(140,705)	\$(102,737)	\$(16,406,685)
19	2	\$(1,336,405)	\$(156,785)	\$(114,478)	\$(18,281,622)
20	3	\$(1,467,431)	\$(172,157)	\$(125,702)	\$1,606,738
21	4	\$(1,592,135)	\$(186,787)	\$(136,384)	\$2,001,608
22	5	\$(1,710,518)	\$(200,675)	\$(146,525)	\$14,176,851
23	6	\$(1,822,292)	\$(213,788)	\$(156,100)	\$14,909,261
24	7	\$2,765,045	\$(226,194)	\$(165,157)	\$20,295,284
25	8	\$2,962,158	\$(237,824)	\$(173,649)	\$21,247,428
26	9	\$3,151,226	\$(248,712)	\$(181,599)	\$22,146,086
27	10	\$3,332,249	\$547,719	\$290,441	\$24,274,420
28	11	\$3,504,938	\$564,439	\$315,251	\$25,122,903
29	12	\$3,669,582	\$580,350	\$339,348	\$25,917,331
30	13	\$3,825,894	\$595,452	\$362,731	\$26,652,735
31	14	\$3,974,160	\$609,745	\$385,375	\$27,334,059
32	15	\$4,114,093	\$623,196	\$407,306	\$27,958,260
33	16	\$4,245,981	\$635,837	\$428,498	\$28,525,936
34	17	\$4,369,536	\$647,669	\$448,977	\$29,036,312
35	18	\$4,485,045	\$658,659	\$468,717	\$29,490,130
36	19	\$4,592,222	\$668,839	\$487,743	\$29,889,815
37	20	\$4,691,353	\$678,210	\$506,031	\$30,233,394
38	21	\$4,782,439	\$686,739	\$523,605	\$30,519,718
39	22	\$4,865,192	\$694,459	\$540,441	\$30,749,229
40	23	\$4,939,900	\$701,369	\$556,563	\$30,922,659
41	24	\$5,006,275	\$707,437	\$571,946	\$31,041,177
42	25	\$5,064,604	\$712,729	\$586,616	\$31,100,783
43	26	\$5,114,601	\$717,145	\$600,547	\$31,106,163
44	27	\$5,156,552	\$720,786	\$613,740	\$31,055,052
45	28	\$5,190,171	\$723,584	\$626,244	\$30,949,079
46	29	\$5,215,744	\$725,573	\$637,985	\$30,784,529
47	30	\$7,839,706	\$1,032,536	\$872,306	\$66,223,860
48	31	\$7,802,352	\$1,027,445	\$878,632	\$65,308,739
49	32	\$7,750,632	\$1,020,737	\$883,678	\$64,252,996
50	33	\$7,684,257	\$1,012,512	\$887,468	\$63,053,513
51	34	\$7,603,228	\$1,002,702	\$889,979	\$61,710,919
52	35	\$7,507,832	\$991,342	\$891,210	\$60,227,559
53	36	\$7,397,782	\$978,397	\$891,185	\$58,598,156
54	37	\$7,273,365	\$963,902	\$889,880	\$20,361,716
55	38	\$7,134,581	\$947,822	\$887,321	\$19,778,566
56	39	\$6,980,856	\$930,226	\$883,481	\$19,152,466
57	40	\$6,813,051	\$911,011	\$878,386	\$8,602,448
IRR		9.51%	6.27%	6.41%	5.75%
MIRR		6.51%	5.11%	5.27%	4.76%
NPV		\$47,395,120	\$3,818,673	\$3,200,296	\$161,664,513
NPV/WFE		\$22,065	\$15,153	\$17,393	\$5,502

APPENDIX TEN

EFFECTS OF MIGRATION

Migration estimates are available for the following levels of attained education:

- Some College 0.27 percent.
- Bachelor's 0.84 percent.
- Graduate/Professional 0.21 percent.

The calculation of the percentages are reflected in Table 3.4 -- South Region Mobility By Attained Education (Over 25 Years Old). To estimate the sensitivity of the rates-of-return to these migration numbers the benefits, or tax collections, associated with education are increased by the above referenced percentages. The MIRR is recalculated based on the enhanced cash inflows to the state of Tennessee. The following table summarizes the rates-of-return under a net immigration scenario.

Effects of Migration on Real Rates-of-Return

Level of Attained Education	Migration Rates	Non-Migration Rates
MEN:		
Some College	5.22%	5.21%
Associate's-Technical	5.95%	5.94%
Associate's-Academic	5.52%	5.51%
Bachelor's	5.29%	5.27%
Master's	6.82%	6.82%
Professional	6.14%	6.13%
Doctorate	5.52%	5.52%
Overall	5.39%	5.38%
WOMEN:		
Some College	4.59%	4.50%
Associate's-Technical	5.95%	5.73%
Associate's-Academic	6.11%	5.86%
Bachelor's	4.11%	4.08%
Master's	6.52%	6.51%
Professional	5.11%	5.11%
Doctorate	5.27%	5.27%
Overall	4.77%	4.76%

The effects of migration on the real rates-of-return are negligible. The overall impact, based on net regional migration of people with higher levels of attained education, is so small that the base case, i.e., no migration rates-of-return, should be used for analysis and planning purposes.

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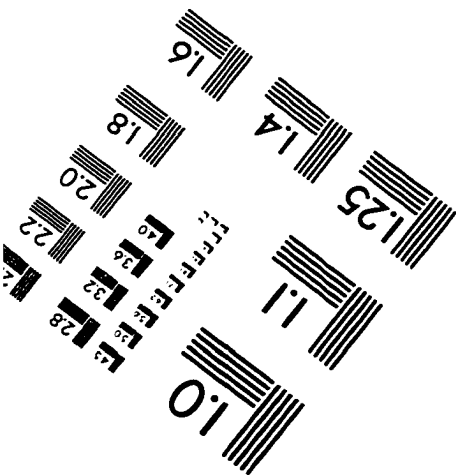
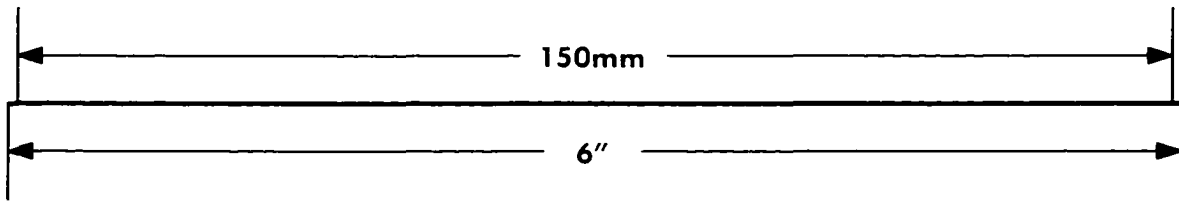
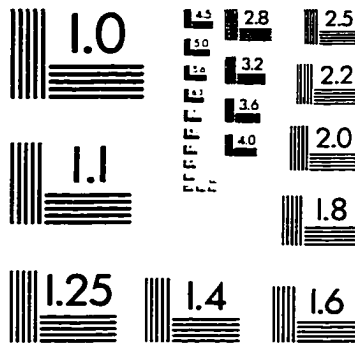
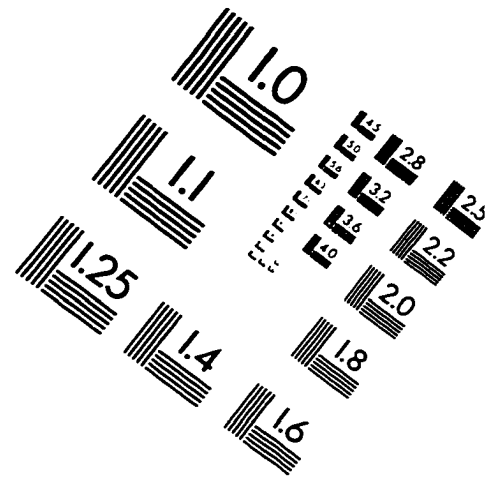
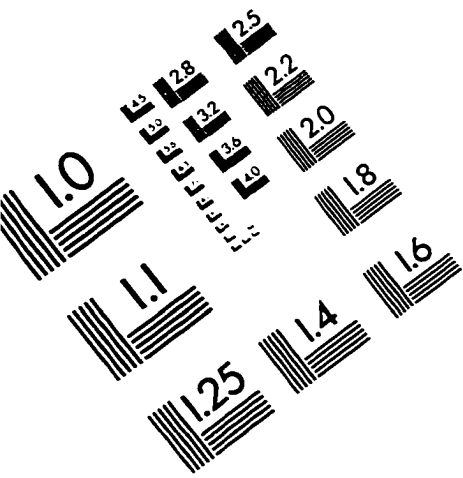
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IMAGE EVALUATION TEST TARGET (QA-3)



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