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Introduction

Human capital theory suggests we can model knowledge as an investment where knowledge has two components: specific human capital which is knowledge that is non-transferable between firms, occupations, or situations and general human capital which is transferable. Within the general theoretical understanding of human capital, the focus has been on the monetary rewards in terms of earned income and on the manner by which a human capital investment augments worker productivity. Those with more education earn more because they are more productive. But, earned income is only part of the story. A rational economic actor may also consider wealth (stock) in addition to income (flow). A correlative relationship exists between wealth and income. Given that earned and unearned income are perfect substitutes as far as their purchasing power is concerned, wealth may play a potentially important role in the labor supply decision and, hence, in the determination of earnings from labor. Therefore, if investments in human capital could influence wealth portfolio decisions, the level of unearned income (primarily income from assets and capital gains) would be affected. In turn, this would alter the labor supply decision of the individual leading to a difference in earned income.[1] Additionally, by looking to wealth instead of just income, we are able to explore the ways in which human capital is valuable for reasons other than increases to productivity. By exploring the role of general and specific human capital on the rate of wealth accumulation, it becomes obvious that this research fills a significant gap in the current literature.

After an introduction to the fundamental elements of human capital theory, I will define the characteristics of general and specific human capital, and show who pays for and yields the benefits from

[1] The correlation between net worth and total income in the 1995 SCF was found to be .35. Dividing total income into earned and unearned income, unearned income had a dramatically greater correlation to net worth (.35) than earned income (.06). Capital gains and income from assets were not surprisingly correlated with net worth (.43 and .41 respectively).

investment in each component. I will then proceed to explain why understanding the magnitude of the rate of return in terms of wealth is imperative, both theoretically and practically. After I develop testable hypotheses, I will introduce the data set to be used, and present my model. Finally, I present the regression results, and provide a direction for future research in this area.

CHAPTER 1: Human Capital Theory

A. The Basic Model

Gary S. Becker's book, Human Capital: A Theoretical and Empirical Analysis with Special Reference to Education, was the first work to model the acquisition of knowledge or skills as an investment.[2] The essence of human capital theory is that expenditures on education and training are investments that individuals or firms make to increase the level of monetary rewards presently received and expected in the future. Since the data sets during the time Becker wrote were unable to fully capture levels of wealth, Becker devoted his research to earned income and the way in which human capital augments one's productivity in the work place.[3] Subsequent research has not deviated far from Becker's focus on earned income and productivity.

Becker understands human capital acquisition as a function of an individual's demand curve for human capital and supply curve of investable funds (figure 1). The demand curve, D1, portrays the marginal rate of return, *r,* earned from each additional dollar spent on human capital by an individual. The demand curve has a negative slope, implying that the rate of return declines with additional

[2]Becker, Gary S. Human Capital. Chicago: University of Chicago Press, 1993.

[3] Becker says, "…in recent years there has been a shift in both theoretical and empirical work from flows to stocks, which suggests that, in studying life-cycle behavior, attention should be paid to age-wealth profiles as well as to the more familiar age-earnings profiles" (223). In this paper, I follow up on Becker's thought regarding how age-wealth profiles differ from age-earnings profiles with differing levels of human capital investment by formally bringing forth a rate of wealth accumulation model with a human capital component.

investment. Also, the rate of return declines because the acquisition of additional human capital leaves the person a fewer working years to recoup the costs and gain the benefits of the investment.

The supply curve facing the individual, S1, portrays the interest rate (marginal cost of funds) that must be paid to acquire each dollar invested in human capital. If the market of loanable funds was perfect, the interest rate would be constant and the supply curve would be elastic. However, because the market for loanable funds for human capital is imperfect, an individual cannot obtain all the funds for human capital even if the investment is worthwhile because the lender cannot repossess the human capital should the individual default on the loan. For most individuals the supply curve of funds, S1, is upward sloping. Additional funds are available at successively higher interest rates until no more will be borrowed; the supply curve is a step-wise function. The intersection of the demand and supply curves determines how much one invests in human capital.

Demand and supply curves differ among individuals. These differences in turn explain differences in the level of human capital acquired. What causes differences in the supply and/or demand curves? One hypothesis often put forth is that each person obtains the same financial return from a given expenditure on on-the-job training (OJT) or formal schooling, but that each person is faced with a different marginal cost of funds curve (figure 2). The person with supply curve S3 has the greatest access to funds; the person with supply curve S1 has the least access. What might cause such differences in supply curves? An important factor is what Becker called differences in opportunity.[4] Opportunity in this sense relates to the availability and cost of funds for investment in schooling. An example of possessing greater opportunity would be that of an individual who is considering acquiring a college education when their parents went to college as opposed to one's parents who did not. That individual may be more likely to acquire this education if their parents went to college (the parents are always

[4] Becker, Gary S. Human Capital. Chicago: University of Chicago Press, 1993. 123-129.

talking about their college days, about the benefits to be gained by going to college, and provide an understanding support network once the child is in college) and in all likelihood will be able to supply their child with a greater amount of financial backing. Inequality of opportunity leads to inequality in human capital. The more unequal is the distribution of opportunity in the population, the more unequal will be the distribution of earned income.

Alternatively, supply curves could be identical for each person but the demand curves could vary (figure 3). What might cause such differences in demand curves? One important factor identified by Becker is differences in individual ability.[5] A more able person would presumably gain more from a given expenditure in human capital than a less able person, resulting in greater market productivity, earnings, and rate of return. Demand curve D1 would be the least able individual, D3 the most able. Although Becker concentrated his analysis on the role of ability as a cause of differences in individual demand curves for human capital, later studies have identified other important factors such as discrimination and school quality.[6] Discrimination would result in a lower rate of return for any given expenditure and schools of higher quality would lead to a higher rate of return.

Finally, the demand and supply curves could be correlated to one another and cause the existence of differences in the level of human capital investment (figure 4).[7] If there is positive correlation among demand and supply curves, the most able persons will also have the greatest access to funds, the

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[5] Becker, Gary S. Human Capital. Chicago: University of Chicago Press, 1993. 171-180.

[6] Bratsberg, Brent and Dek Terrell.. "Experience, Tenure, and Wage Growth of Young Black and White Men." Journal of Human Resources. 33:3 (Summer 1998). 658-692.

Stanley, T.D. and Stephen B. Jarrell. "Gender Wage Discrimination Bias." Journal of Human Resources. 33:4 (Fall 1998). 947-973.

Brewer, Dominic J., Eric Eide, and Ronald G. Ehrenberg. "Does it Pay to Attend an Elite Private College?" Journal of Human Resources. 34 (Winter 1999). 104-123.

[7] Becker, Gary S. Human Capital. Chicago: University of Chicago Press, 1993. 115-117.

equilibrium point P33. If there is a negative correlation between the demand and supply curves, the most able will have the equilibrium point P31. With a positive correlation, the degree of inequality is clearly much larger.

B. A Comparison of General and Firm-Specific Human Capital

1. Defining Characteristics

General human capital has traditionally been understood as knowledge that increases a worker's productivity in a wide variety of circumstances. The most common example of general human capital is formal schooling. This schooling could consist of not only academic subjects such as economics or philosophy but could also include training for skills like carpentry or small engine repair. The key is that a worker with this type of capital possesses skills that are completely transferable among different firms, occupations, and industries. During a move between firms, occupations, or industries, a worker with general human capital has the same level of productivity after the move as they did beforehand.

In contrast, specific human capital increases a worker's productivity only in a single firm, industry, or occupation. An example of firm-specific human capital is a worker being trained how to operate a machine that is utilized in only a single firm or a worker gaining knowledge of the layout of the firm. The key is that a worker with this type of capital possesses skills that are not transferable among different firms, occupations, and industries. During a move between firms, occupations, or industries, a worker with specific human capital has a lower level of productivity after the move compared to the level that existed beforehand. The type of human capital that an individual decides to accumulate, whether it is general or specific in nature, is to a large degree determined by the rate of return they believe to exist for each type of investment. The rates of return are determined by comparing the discounted future benefits to the costs.

2. The Benefits and Costs for Each Component

The costs of obtaining general human capital are of two types (figure 5): direct costs and opportunity costs. Direct costs include such expenses as tuition and books. These direct costs, while more obvious, are low relative to the opportunity costs incurred (the earnings that are foregone as one is devotes to schooling). The magnitude of the opportunity cost in part depends on the productivity of the worker if general human capital investment were to stop.

The costs of obtaining specific human capital are also of two types (figure 5): direct and opportunity costs. The direct cost covers the materials and resources required to conduct the training. The opportunity cost arises from the fact that an employee in the short-run typically receives lower wages than could earned in a position that requires no training. The opportunity cost incurred represents the higher level of earnings foregone.

The worker bears the direct cost of general human capital. Assuming a perfectly competitive labor market, if the firm were to bear the direct cost of training, it would initially have to pay the worker a wage in excess of the worker's marginal revenue product (wage W0 even though MRP1 in figure 6). When the worker completed his training, his productivity would rise to a point where their wage equaled his marginal revenue product. If at this point the firm were to pay a wage lower than the marginal revenue product of the worker, the firm could earn a positive rate of return on its investment. But general training is transferable. If the firm were to pay less than the marginal revenue product the worker would quit and find employment at a firm willing to pay a wage equal to his or her productivity. Competition for labor, in conjunction with the transferable nature of the training, makes it impossible for the firm to pay a wage less than the marginal revenue product of the worker. Paying a wage that is equal to the marginal revenue product of the worker, the firm is unable to recoup its investment, making it unwilling

to bear the costs of general training. As a result, the individual funds the acquisition of general human capital.

The firm bears the direct cost of specific human capital. Once training is completed at one firm or industry, the productivity of the same worker at a different firm or industry decreases to the pre-training level. Even though the firm that provided the training receives a higher marginal revenue product, it need not necessarily pay the worker more since the worker can do no better elsewhere. To induce workers to acquire specific human capital, the firm must bear the cost of training by initially paying a wage higher than the worker's productivity (W0 even though MRP1 in figure 6). The return on the firm's investment is the difference between the worker's higher productivity in subsequent periods and the wage, which is lower than the marginal productivity after training is completed. In practice, the post-training wage paid by the firm would generally be higher than the minimum wage that could be paid before the worker quits (W0). The wage paid might be higher than this threshold wage because of a bilateral monopoly between the worker and the firm. This means that both the worker and the firm have some monopoly power over the other. Should the worker with specific training quit, the firm would lose its investment in training. To prevent this, the firm has an incentive to share a portion of its return with the worker (W3). The firm also has power over the worker. Should the worker demand a wage so high that it eliminates the firm's return on its investment, the worker would be laid off, imposing a financial loss on the worker since he or she could only earn a lower wage at other firms.

3. Rates of Return

Human capital theory hypothesizes that the rate of return for general knowledge in terms of earnings will be positive because workers with general knowledge are more productive due to their increased facility for logical reasoning, conceptualization, and communication, as well as more specific job skills imparted in accounting and engineering courses. Furthermore, workers with general knowledge

are able to earn wages that closely reflect their productivity. If the firm were to pay a wage that was lower than the value of the worker's productivity, the worker would find a job elsewhere without causing a decrease in their level of productivity (their skills are mobile).

Similarly, human capital theory hypothesizes that the rate of return for specific knowledge in terms of earnings will be positive because workers with specific knowledge are more productive as they become more adept at operating specific machinery or producing a specific product. As an individual's productivity increases, it is assumed that the increase will be taken note of and that wages will increase (albeit wages will not rise by the whole productivity increase).

Figure 1-1: Supply and Demand of Human Capital

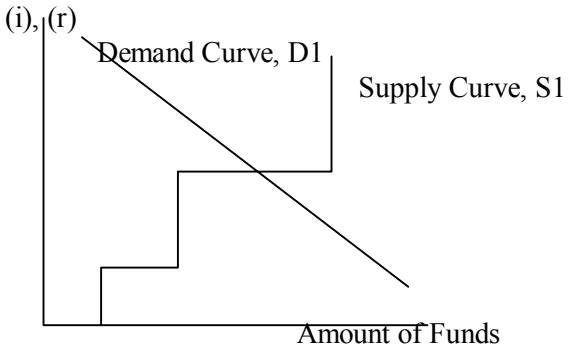


Figure 1-2: Common Demand Curve Hypothesis

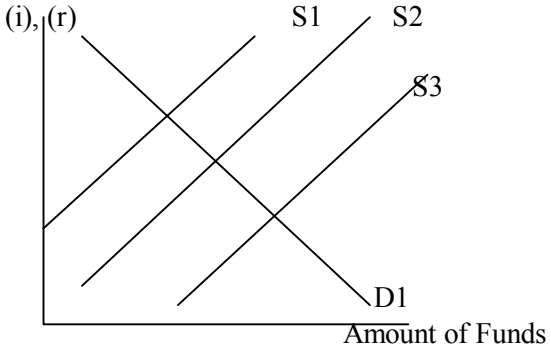


Figure 1-3: Common Supply Curve Hypothesis

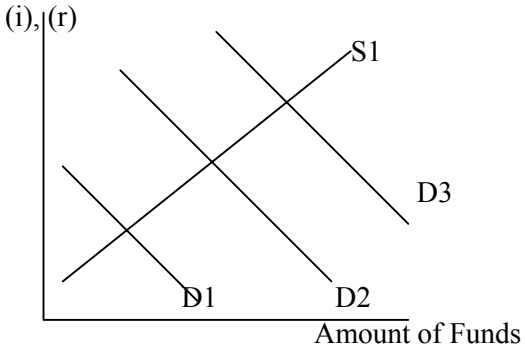


Figure 1-4: Correlation Between Demand and Supply Curve

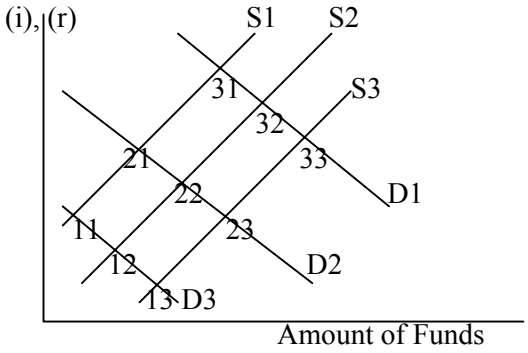


Figure 1-5: Costs of Human Capital Investment

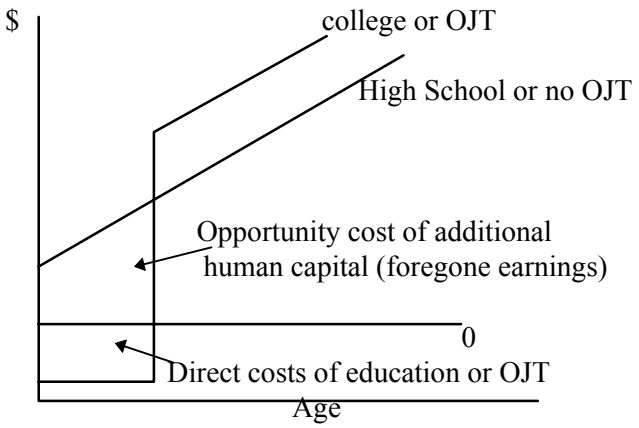
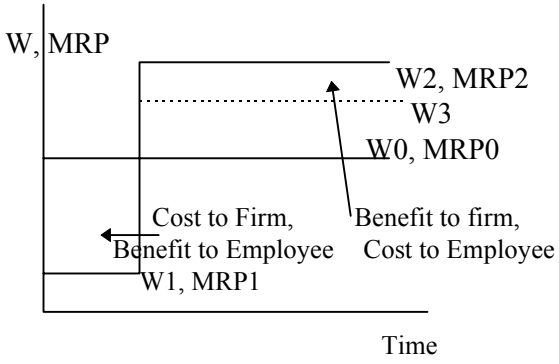


Figure 1-6: Costs and Benefits of Human Capital Investment



CHAPTER 2: Hypothesis

I hypothesize that general human capital yields a higher rate of wealth accumulation than specific human capital. I expect this because of the way that general human capital augments the ability to make wise investment decisions and as a result create a higher yielding financial portfolio. It seems likely that an individual with a college education consults the right sources for investing information and "gets more out" of those conversations or readings than an individual without such an education and that this advantage is more valuable than higher earnings due to an investment in job experience.

Making wise investment decisions requires an individual to have rational expectations not only for their own future but that of the overall economy as well. General human capital in a way is similar to

an insurance policy. Regardless of the financial condition of the company they are currently employed at and even to some degree the general condition of the economy, an individual with a substantial investment in general human capital has a more predictable income stream. Since the expectations of these individuals closely mirrors what actually happens in the future, one can more rationally allocate their savings to the "best" combination of assets and debts where the risk "fits their lifestyle" in a close manner.

Moreover there are a greater number of investment decisions available to those who invest a greater absolute amount (those with a greater investment in general human capital). Individuals with an investment in general human capital earn more and therefore are more likely to be able to invest in treasury bills or investment real estate. The ability to make a wider variety of investments leads to a rate of return on investments in general that is higher given preferences towards risk.

There are also ways, however, that an investment in specific human capital augments wealth accumulation beyond the way it affects earned income. The more specific an individual's investment in knowledge, the less likely a firm will be to lay off the worker. That worker then will then be similar to the investor in general human capital, where expectations of future income closely mirror what actually happens. Furthermore, a worker with a greater investment in specific human capital may be rewarded for reasons other than increases in productivity (i.e., the high cost of replacing the employee). As an employer's investment in a worker becomes greater, the employer may seek a sort of "non-refundable" deposit in case the worker departs. If the employer allows the worker to invest in non-vested pension or savings plans, the worker may remain with the employer so as not to lose this investment.

To summarize, general human capital increases one's productivity in a wide variety of firms, thus leading to higher earnings but also increases the rate at which wealth accumulates due to an ability to make "better decisions" and to have a clearer picture of future earnings. Specific human capital not only increases one's productivity in a single firm or group of firms which in turn leads to higher earnings, but

also increases the rate at which wealth accumulates because of actions by the employer to further restrict the mobility of the worker. Again, I expect the effect of general human capital on wealth accumulation to be larger than the effect of specific human capital.

CHAPTER 4: Introduction to the Data

The data used to test this hypothesis are from the 1995 Survey of Consumer Finances (SCF). The SCF is sponsored by the Board of Governors of the Federal Reserve System and conducted in cooperation with the Statistics of Income Division of the IRS. The interviews were conducted from June to December of 1995 by the National Opinion Research Center at the University of Chicago, took about 90 minutes per observation to complete, and were performed in person at the individual's private residence with the assistance of a computer-based personal interviewing program. The SCF provides data on wealth and capital gains; it reports current market value of assets and cost-basis value of housing and real estate, business investment, mutual funds, stocks. The SCF collects over 1500 variables, of which I have extracted about 200.[8]

Surveys before the SCF under-sampled the very wealthy. Under-sampling occurred because those with more wealth typically have a higher non-response rate. Since the severity of wealth inequality implies that an exclusion of the very wealthy prevents us from measuring a great amount of total wealth, these data sets were unable to produce results that replicated the actual distribution of wealth. Another problem often encountered in collecting cross-sectional data on assets, liabilities, and income before the SCF was that wealthy households are the most likely to hold some assets and debts such as investment real estate and treasury bills. To provide an adequate basis for the analysis of these investments, the SCF

[8] Generated variables such as net worth were courtesy of a program written by Darryl Getter of the U.S. Naval Academy. This program is similar to a net worth program located on the Federal Reserve Board website.
http://www.federalreserve.gov:80/pubs/OSS/oss2/95/codebk95pt5.html

employs a dual-frame sample. The dual-frame sample includes both an area probability design (a sufficiently large, unbiased, nationally representative, and geographically based sample of households in general) and a special list sample (high-income households) of tax returns selected by the Statistics of Income Division of the IRS (SID). The SID predicts the amount of wealth given the taxable income level utilizing the assumption that there is a high correlation between levels of taxable income and wealth. The wealth index variable serves as the basis for the survey's over-sampling of the very wealthy. The cutoff income level used by the SID to determine who is wealthy and who is not is not released to the general public.

To make unbiased and consistent estimation possible, the SCF makes weighting adjustments for its sampling strategy and also to account for non-responses in the survey.[9] The inclusion of the high-income sample, appropriately weighted, significantly reduces differences between survey data and other estimates. The same questionnaire was used to interview both the cross-section and high-income samples and field interviewers were not told which households were in the high-income sample.[10] For the 1995 survey, 4,299 families were interviewed with 2,780 in the nationally representative sample and 1,519 in the high-income sample. In the SCF, a household unit is divided into a "primary economic unit" (PEU) and everyone else in the household. The PEU is intended to be the economically dominant single individual or pair of individuals and all other persons who are financially dependent on that person or those persons.

[9] Response rates differ markedly in the two parts of the SCF sample. About 70% of the families selected for the nationally representative sample actually completed interviews. The overall response rate in the wealthier sample was about 34%.

[10] Although one might imagine that it would not be extremely difficult for the interviewer to accurately guess the status of the respondent given that the interviews were conducted at one's private residence.

This data set of 4,299 observations were replicated five times, creating a net result of 21,495 observations. The original observations were replicated for two important reasons: the public disclosure of the data set and the existence of missing observations.

Since the SCF is a public data set and respondents are volunteering their private, detailed information of their financial holdings, there are disclosure concerns. Replication makes unusual observations appear less unusual. This in turn reduces the likelihood that a wealthy individual (of which there are many in this data set) could be identified by one analyzing the public data set.

More importantly though, there was not a single observation in the original data set where all questions were fully answered. Missing data in these observations includes instances when the individual gave a range instead of an exact value, when the individual had no idea of either an exact value or a range, or refused to answer the question.[11] Multiple imputation, which has been used in the SCF since 1989, allows us to reasonably guess with a high level of confidence what the actual value is.

The multiple imputation in the SCF is conducted via the FRITZ model. The FRITZ imputation model for missing and range responses corrects for a missing response by using the distribution of available responses to impute a value for the missing response. Given that a variable should be imputed, the FRITZ model computes a regression for the case using the variables that either were not missing in the beginning or those values that were already imputed within that particular iteration. Once a response has been imputed, its value is taken in later imputations as if the respondent originally reported it.

Each missing or range value is imputed separately for each iteration. In the first iteration, all the relevant population moments for the imputation models are computed using available data. As imputations increase in that particular iteration, the imputations are based on increasingly complete

[11] 17% of the respondents didn't even know whether or not they had a certificate of deposit. Only 1% of those that knew for sure they had a C.D., knew the exact value of it. Between 60-80% of the respondents could give an exact value for Business investment, Municipal Bonds, mutual funds, Stocks, and Trusts. The remaining portion either gave a range value or refused to answer.

information. In the second iteration, all missing or range values are computed using the first iteration observation as if it had been information directly given by the respondent. After the first few iterations, the distribution of key imputed values for variables changes little.

With the FRITZ model in mind, an important question is how the imputed observations affect the results. Simulation experiments show that the distributions of the actual and simulated data differ little in their range.[12] Thus, even though a great deal of the data set consists of simulated data, we can be quite confident that by conditioning the imputations on reported dollar values, we have accurate information.

There exist five limitations to the data set (listed in descending order of importance):

1. The SCF, to generate a net worth variable, does not include non-privately held pensions or Social Security in the equation. These however are two assets that are very important to individuals and increases in importance in one's total wealth portfolio as the individual ages.[13] Approximately one- half of all households are covered by employer provided pensions and nearly everyone is covered by Social Security. The fact that these two assets are the most heavily relied upon in retirement implies that their size relative to other non-pension net worth is quite large.[14] Using the 1992 SCF, Kennickell found that the overall median pension wealth was approximately five times the size of financial assets for all households and about three-quarters

[12] Kennickell, Arthur B. "Multiple Imputation in the Survey of Consumer Finances." Survey of Consumer Finances Working Paper. Available at http://www.bog.frb.fed.us/pubs/oss/oss2/papers/multipleimp.pdf

[13] Kennickell, Arthur B. and Sunden, Annika E. "Pensions, Social Security, and the Distribution of Wealth." Available at http://www.bog.frb.fed.us/pubs/oss/oss2/papers/pension.k_s.pdf.

[14] Some estimates by McDermed et. al. (1989) estimate that pensions represent 43% of net worth for households with pensions.

McDermed, Ann A., Robert L. Clark, Steven G. Allen. "Pension Wealth, Age-Wealth Profiles, and the Distribution of Net Worth" in The Measurement of Saving, Investment, and Wealth. eds. R Lipsey and Helen Stone, Chicago: The University of Chicago Press, 1989.

as large as net worth and that Social Security wealth was more than twice the median net worth. Overall, he found that Social Security and pensions constitute about 82% of total net worth. Thus, the results underestimate the total amount of wealth and bias the rates of return to human capital in a downward direction.

2. Another limitation to the data compiled from the data set has to do with the way the data set is organized. The data in the survey are for a subset of the household unit referred to as the primary economic unit. The primary economic unit consists of an economically dominant single individual or couple in a household and all other individuals in the household who are financially dependent on that individual or couple. For simplicity sake, I analyzed data devoted to the head of the household. This of course brings up many problems because I then find myself focusing mainly on males. Those females that I am able to get data on are predominantly found in single mother households. The result is that I most likely overestimate for the individual the average amount of net worth held, the amount of human capital investment, and the amount of earned and unearned income. At the same time, I underestimated the amount of earned income by including only earned income from one's primary full-time job.

3. Understanding the weighting design system used to treat these observations in accordance with their overall existence rate in society (the fact that the very wealth were over-sampled yet make up a small portion of the total population) is critical to the interpretation of all the results. I encountered great difficulty however when I was attempting to understand the weighting system. Thus, I was faced with a choice of either not using the weighting system yet retaining all the observations or removing the very wealthy observations that were over-sampled making it then unnecessary to use the weighting system. I chose the latter option and trimmed off the top 5% of total income earners in an attempt to remove the very wealthy and eliminate my need for

using the weighting.[15] In all likelihood, I was not able to properly remove all members that were in the wealthy sample from the data set. With the unintended retention of some of these observations combined with the nonuse of the weights, I am most likely left with regression equations containing biased estimators.

4. The designers of the high-income sample for the SCF assume that income flows are good proxy variables for wealth. Arthur Kennickell found that a number of people in the *Forbes 400*, a group that is excluded from being sampled in the SCF because of their prominence, did not in fact have the highest income.[16] Kennickell concluded that the relationship between income and wealth is not as straightforward as it seems, and that the way the wealth indices are calculated from income in actuality do not properly distinguish between those that are very wealthy and those that are not. Thus, my removal of observations that had high levels of income in order to remove those observations that had a great amount of wealth was most likely unsuccessful.

5. My results were generated using STATA, which treats each of the five implicates as an independent observation and correspondingly inflates the reported significance of the results (biased t-statistics).

CHAPTER 6: Model

In this section, I model the effect of general and specific human capital on the rate of wealth accumulation above and beyond the effect the components have on earned income (an effect which has been widely documented in the literature). Wealth is represented by the summation of previous savings. Savings come from two sources: earned and unearned income. Thus, wealth is a function of savings

[15] The threshold was $973,000 with 1,074 observations being removed leaving a net number of observations of 20,421.

from earned income and unearned income. Human capital theory predicts that earned income is a function of general human capital, specific human capital, and a matrix of assorted household characteristics such as age, race, and gender.[17] A greater investment in general human capital leads to more productive worker that earns more. A greater investment in specific human capital also leads to a more productive worker who earns more.

[1] Earned Income=f(general human capital, specific human capital, household characteristics)

Unearned income is modeled in a similar manner with the independent variables: general human capital, specific human capital, and other characteristics influence the level of income from assets. We would expect that a higher investment in general human capital may lead to different investment choices which in turn affects the level of unearned income. A higher investment in specific human capital may lead to greater investments in pension plans or ownership of shares in the company, *ceteris paribus*, than those with a smaller investment. Additionally, we would expect the total amount of net worth one possesses to affect the level of unearned income. When one has a greater amount of wealth they are able to make certain investments such as in treasury bills. This portfolio choice in turn affects the level of unearned income. Thus,

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[16] Kennickell, Arthur, B. "Using Income Data to Predict Wealth." Available at http://www.federalreserve.gov/pubs/oss/oss2/papers/wealth.income.6.web.pdf

[17] This earned income model specification is most famously noted in
Becker, Gary S. Human Capital. Chicago: University of Chicago Press, 1993

Schweitzer, Mark E. "Workforce Composition and Earnings Inequality." Economic Review. Federal Reserve Bank of Cleveland. 33 (Quarter 2 1997). 13-24.

Mincer, Jacob. Schooling, Experience, and Earnings. New York: NBER. 1974.

[2] Unearned Income=f(general human capital, specific human capital, net worth, household characteristics)

Pensions are one of the primary sources of increases in unearned income that accrue with an investment in specific human capital. That the generated net worth variable does not reflect the value of an individual's pension, we would no longer expect specific human capital to play a role in the level of unearned income.[18] As such, I respecified the equation 2 to yield:

[3] Unearned Income=f(general human capital, net worth, household characteristics).

To estimate equations 1 and 2, the following regression models were entered into STATA.[19] Because the data set did not include pensions, I did not include the specific human capital variable in the unearned income equation.

$$[4] EI = a_0 + a_1 GHC + a_2 SHC + a_3 \chi + \varepsilon$$
$$[5] UI = b_0 + b_1 GHC + b_2 \chi + \varepsilon$$

We can combine these two components to estimate a change in wealth where:

$$[6]\ \Delta W = C_0 + C_1 EI + C_2 UI + C_3 \chi + \varepsilon$$

with C_1 and C_2 representing the marginal propensity to save of each component of income. Then substituting equations 3 and 4 into equation 5 we get:

[18] Since the proxy variable for specific human capital is the length of one's employment with a specific employer, beyond pensions, there is no other major source of unearned income that accrue with longevity. By removing specific human capital, we ought to keep in mind while interpreting the results that a misspecification bias may exist.

[19] GHC represents general human capital, SHC represents specific human capital, and χ represents household characteristics.

$$\Delta W = C_0 + C_1(a_0 + a_1 GHC + a_2 SHC + a_3 \chi) + C_2(b_0 + b_1 GHC + b_3 \chi)$$

yields

$$[7]\Delta W = (C_0 + C_1 a_0 + C_2 b_0) + (C_1 a_1 + C_2 b_1) GHC + C_1 a_2 SHC + (C_1 a_3 + C_2 b_3)\chi$$

Equation 7 represents a flow of wealth where the dependent variable measures the change in wealth that occurs on an annual basis. The same variables which are correlated with a change in the flow of wealth we would expect would also affect the stock of wealth. This reasoning yields the following equation:

$$[8] LnWealth = \alpha + \beta_1 GHC + \beta_2 SHC + \beta_3 \chi + \beta_4 Total\ Income$$

The total income term was added because higher total income allows the investor to diversity into assets such as treasury, municipal, and corporate bonds that require higher minimum investments. Including total income allows us to account for risk and portfolio choice differences among the various income strata.

This discussion yields the following equations:

$$[9] Ln\,Wealth = \alpha + \beta_1 GHC + \beta_2 SHC + \beta_3 \chi + \beta_4 Total\ Income + \varepsilon$$

$$[10] Ln\ Unearned\ Income = \alpha + \beta_1 GHC + \beta_2 \chi + \beta_3 Net\,Worth + \varepsilon$$

$$[11] Ln\,Earned\ Income = \alpha + \beta_1 GHC + \beta_2 SHC + \beta_3 \chi + \varepsilon$$

Similarly, we can consider capital gains and income from assets as a function of net worth. Since income from assets is a part of total unearned income, equation 10 will suffice. Additionally, since capital gains do not include pensions, equation 10 will also suffice as an adequate description.

$$[12] Ln\,Capital\,Gains = \alpha + \beta_1 GHC + \beta_2 \chi + \beta_3 Net\,Worth$$

$$[13] Ln\ Income\ From\ Assets = \alpha + \beta_1 GHC + \beta_2 \chi + \beta_3 Net\,Worth$$

At this point, we may be concerned about the existence of a simultaneous relationship where wealth is a function of total income and unearned income (which is a part of total income) is a function of net worth.[20]

If the coefficient on net worth in equation 10 is nonzero, then we would expect there to exist a simultaneous relationship between equations 9 and 10 thus necessitating two stage least squares. If however B_3 was zero then we would expect equations 9 and 10 to be recursive which would allow each equation to be treated separately with an OLS regression. Estimating equation 10 revealed that B_3 was indeed zero (about $2*10^{-8}$). Limiting the sample to certain characteristics continued to yield a zero coefficient.[21] It appears that a recursive relationship exists between equations 9 and 10.

CHAPTER 7: Regression Results

The results indicate that 54 percent of the variation in net worth in equation 9 can be accounted for by the variation in the independent variables. All the coefficients, except the variable representing Asians, are statistically significant and have expected signs. An additional year of education yields a 28% increase, an additional year of work experience brings about a 11.6% increase, being Hispanic leaves a person with about 48% decrease (relative to a white's), being African American leaves a person

[20]Earned income however would not be a function of net worth. While we might expect that if an individual had a great amount of wealth they could take on a more appealing yet lower paying position. This would occur as the individual replaced their lost earned income with unearned income. Removing the wealthy subsample though reduces the likelihood of this phenomenon occurring.

[21] The sample was limited to specific occupations and to observations where the household had net worth greater than -$1,000,000. The coefficient on net worth maintained a zero value.

with an 112% decrease (relative to a white's), being male led to a 95% increase (relative to a female's), and being an additional year older led to net worth that annually accumulated at 14% greater rate.[22]

These results also indicate that 27% of the variation in unearned income (the dependent variable) in equation 10 can be explained by variation in independent variables. All of the coefficients, except the variable representing Asians, are statistically significant and nearly all the coefficients have expected signs with the notable exception being Hispanics. An additional year of formal schooling leads to a 16.5% increase, being an African American leads to a 20% decrease (relative to a white's), unexpectedly it was found that being Hispanic leads to a 54% increase (relative to a white's), being male leads to a 56% increase, and being an additional year older leads to a 11% increase in the annual rate at which unearned income is received.[23]

These results indicate that 33% of the variation in earned income from equation 11 can be accounted for by variation in the independent variables. Nearly all of the coefficients (with the notable exceptions being Asian or Hispanic) have statistically significant coefficients and have the expected sign. An additional year of formal schooling leads to nearly a 14% increase, an additional year of experience leads to a 9% increase, being male leads to a 78% increase (relative to female's), being African American leads to a 22% decrease (relative to white's), and being an additional year older increases the rate at which earned income annually increases by less than 1%.[24]

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[22] These compounded rates were 33.6% increase for an additional year of education, a 12.7% increase for an addtional year of experience, a 59.9% decrease for being Hispanic (relative to a white), a 213% decrease for being African American (relative to a white), a 169% for being male (relative to a female), and a 15% increase in the rate at which wealth annually increased for being a year older.

[23] These compounded rates were 17.9% increase for an additional year of education, a 71.6% increase for being Hispanic (relative to a white), a 22% decrease for being African American (relative to a white), a 75% increase for being male (relative to a female), and a 11.6% increase in the rate at which wealth annually increased for being a year older.

[24] These compounded rates were 14% increase for an additional year of education, a 7% increase for an additional year of job experience, a 78% decrease for being African American (relative to a white), a

Additionally, these results indicate that 25% of the variation in total capital gains from equation 12 could be accounted for by variation in the independent variables. Except for Asians, all of the variables are statistically significant and have the expected sign. An additional year of schooling leads to a 25% increase, being male leads to a 55% increase (relative to a female's), being Hispanic leads to a 111% decrease, and being African American leads to 150% decrease (relative to a white's) in the rate at which both realized and unrealized capital gains are annually accumulated.[25]

Finally, these results indicate that 23% of the variation in income from assets from equation 13 could be explained by variation in the independent variables. Nearly all of the coefficients (except Hispanics) have statistically significant coefficients and all of them have the expected sign. An additional year of schooling leads to a 26% increase, being Asian leads to a 24% decrease (relative to a white), being African American leads to a 124% decrease, and being male leads to a 129% increase (relative to a Female) in the rate at which income from assets are annually received.[26]

What we see in the equations of net worth, earned income, unearned income, income from assets, and capital gains is that general human capital, as represented by years of formal schooling, is the most valuable type of human capital investment across the board.[27] For example, let's take the average

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115% increase for being male (relative to a female), and a 9.3% increase in the rate at which wealth annually increased for being a year older.

[25] These compounded rates were 28% increase for an additional year of education, a 67% decrease for being Hispanic (relative to a white), a 78% decrease for being African American (relative to a white), a 73% for being male (relative to a female), and a 17% increase in the rate at which wealth annually increased for being a year older.

[26]These compounded rates were 30% increase for an additional year of education, a 78% decrease for being Asian (relative to a white), a 29% decrease for being African American (relative to a white), a 263% for being male (relative to a female), and a 23% increase in the rate at which wealth annually increased for being a year older.

[27] Each of these regressions were tested to see if any of the assumptions of the ordinary least squares method were violated. For each of the models, the error term was normally distributed, multicollinearity

individual that is just getting out of high school. The individual's decision is one between acquiring more general human capital or beginning an investment in specific human capital. Those with a college degree annually accumulated net worth at a rate 112% greater than those with a high school degree. It would take 10 years of continuous employment with a single employer for the high school graduate to overcome that disadvantage. Part of this difference comes from the fact that college graduates have earned income that accumulates at a rate that is 42% greater than that of a high school graduate and that it takes 8 years of continuous employment for a single employer to overcome that disadvantage. Furthermore, those with a college degree have unearned income that increases at a rate 74% greater, income from assets that increases at a rate 116% greater, and capital gains that increase at a rate 102% greater than for those with just a high school education.

We note that the value of a general human capital is greatest in terms of increases in the annual rate of net worth accumulation (a year of education yields a 29% instantaneous increase and a 33.6% compounded increase) and least valuable in terms of earned income (a year of education yields a 14% instantaneous increase and a 15% compounded increase). The value of specific human capital is also greatest in terms of increases in net worth (an additional year of work experience yields a 11.4% instantaneous increase and a 12.07% compounded increase) and least valuable in terms of earned income (an additional year of experience yields a 9%instantaous increase and a 9.4% compounded increase). My results imply that the finding of the literature on human capital have under-estimated the total benefits that accrue to those who invest in general human capital by focusing only on earned income.

Overall, human capital theorists would expect the signs I found on the coefficients. One problem though was not being able to compare the magnitudes on my coefficients to others. To some degree, I was able do this with the earned income equation. With most researchers placing a .02 or .03 value of

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was non-existent, and heteroscedasticity appeared to be only a slight problem in the earned income model. See Appendix E.

the years of work experience coefficient, my result of .068 is not too far from this given that the previous research was conducted in the early to mid-1980s. That human capital measures had a positive coefficient in the rate of wealth accumulation model signifies the fact that those with a greater investment in general human capital also tend to have a greater investment in specific human capital and that these two forces together in all likelihood leads to more informed workers (have the ability to gather more information from a investment prospectus) who have a greater ability to predict future income (because of the long-term relationship expected with their current employer) and have a more diversified investment profile (the greater income levels that come from a higher level of productivity can be used in investment real estate and bonds where large levels of money are necessary).

An expected result involved disparity in the rates of return between the races and gender. The degree of disparity between genders appears to be more severe than that between races although one must remember that only about 25% of my data set consisted of females. An African American female accumulates wealth at an annual rate 114% less than that of White female while an African American male accumulates wealth at an annual rate 14% less than that of a White male. It appears that among the races, that the degree of disparity was most severe for African Americans and least severe for Asians. This disparity is not entirely due to outright discrimination on the work place. Rather, as we found earlier, females and non-whites had much lower investments in both general and specific human capital. Is it the case that females and non-whites feel their prospects in the work place for success are much lower than a male's or white's? Or, is it an issue of sorting where males and whites congregate in occupations that require and reward large investments in human capital and as such large monetary rewards are also given?

An unexpected result involves the interaction term between the two types of investment. It implies that the value of specific human capital given an investment in general human capital actually decreases instead of increases, as human capital theory would expect. Why did this occur? Perhaps for

the same reason why we found that those with larger investments in general human capital remained at a single employer for a longer period of time. One reason may have to do with the fact that pensions and social security assets were not included in the data set. Another interesting reason may have to do with the fact that my data set included observations for only the economically dominant individual of the primary economic unit of the household. Does the behavior of the economically dominant individual significantly differ from that of that of other individuals? We might expect that the economically dominant individual would perhaps be slightly more conservative than another individual because all the individuals of the PEU rely on their income or wealth (an individual prefers a greater deal of security over risk when more individuals rely on your income or wealth).

A result that bears some additional attention is the zero coefficient found on total income in the net worth equation (equation 10) and on net worth in the unearned income equation (equation 11). It would seem only reasonable that having a greater amount of total income would cause investment decisions that yield less liquidity of funds but at the same generates an increase in the rate at which net worth annually increases. Additionally, it would seem only reasonable that having a greater amount of net worth would allow someone to engage in investments such as investment real estate and treasury bills which although they require large investments of funds would affect the rate at which unearned income is received. Either limitations of the data set generated this problem or that low current income really does not constitute a constraint. Moreover, had net worth been nonzero, a simultaneous relationship would have existed, two stage least squares would be necessary. The results of a two stage least squares may have differed from the OlS results.

Let me reiterate the result that general human capital is substantially more valuable than specific human capital in terms of increases in the rate of net worth accumulation and least valuable in terms of increases in the rate of earned income received. Insufficient information exists however as to why a relationship exists. It cannot be said whether those with a greater investment in general human capital

have a greater ability in gathering information from an investment prospectus or more rational expectations of the future. In other words, we have established a correlative relationship but not a causal relationship between human capital and the rate of wealth accumulation.

I found that those with the most years of schooling (the proxy for general human capital) tended to have the most job experience (the proxy for specific human capital). In other words, those who have the most general human capital have the capability of being mobile in the workplace but choose not to move. That mobility does not occur calls into question many of the reasons we had for making the particular hypothesis that we did.[28] More important in regards to our study of inequality, why do workers with a relatively small investment in general human capital choose not to invest in specific human capital? Is it the case that they do not have a choice in the matter, i.e. they are involuntarily separated from their employers, that they do not know that a long-term relationship with an employer will be beneficial in the long-run, that they look only to the short-run future instead of the long-term, or is it some combination of some, all, or none of these reasons? Perhaps it is the case that the term general human capital is a misnomer. As a worker acquires a greater deal of schooling, the individual eventually reaches a point where the knowledge becomes more and more specific to the point where one's doctorate dissertation is on a highly specific topic in a single discipline. When these individuals enter the work place they then remain with a single firm for an extended period of time because of the lack of options that allow them to apply their highly specialized knowledge. Or, it might be the case that a large investment in schooling has the capability of being very mobile but that it need not necessarily be the case. There is in all likelihood a greater marketability of skills such as carpentry or plumbing than doctorates in English literature. The greater the marketability the greater the potential mobility of the individual. In other words, there is a non-linear relationship between years of education and years with

[28] Reasons such as why those with more education may be able to better predict their future income and our understanding general human capital similar to an insurance policy.

an employer.

Table 7-1: Regression Results

Variables	Natural log of net worth (9)	Natural log of unearned income (10)	Natural log of earned income (11)	Natural log of capital gains (12)	Natural log of income from assets (13)
Age	**.138 (29.10)**	**.110 (18.68)**	**.089 (23.70)**	**.160 (11.61)**	**.206 (21.98)**
Age Squared	**-.001 (-16.33)**	**-.0004 (-8.51)**	**-.001 (-23.17)**	**-.001 (-6.44)**	**-.001 (-15.80)**
Being Male	**.946 (30.13)**	**.565 (14.21)**	**.764 (35.69)**	**.551 (5.61)**	**1.289 (19.81)**
Years of experience	**.116 (18.29)**		**.068 (15.70)**		
Years of experience squared	**-.001 (-10.62)**		**-.001 (-14.24)**		
Years of Education	**.279 (51.30)**	**.165 (29.02)**	**.130 (31.31)**	**.248 (16.73)**	**.263 (29.02)**
Interaction between ed. And ex.	**-.003 (-8.18)**		**-.01 (-3.47)**		
Asian	**-.104 (-1.73)**	**-.111 (-1.36)**	**.037 (.99)**	**.110 (.67)**	**-.243 (-2.12)**
Hispanic	**.478 (-7.43)**	**.544 (5.83)**	**-.042 (-1.08)**	**-1.115 (-3.44)**	**.282 (1.57)**
African American	**-1.120 (-24.45)**	**-.202 (-3.12)**	**-.251 (-8.75)**	**-1.504 (-6.03)**	**-1.245 (-8.88)**
Total Income	**1.54e-6 (40.31)**				
Total Income squared	**-4.68e-14 (-30.09)**				

Net Worth		**2.07e-8 (20.65)**		**1.79e-8 (14.60)**	**2.31e-8 (18.82)**
Constant	**1.896 (14.21)**	**2.032 (12.45)**	**5.772 (59.84)**	**-1.189 (-2.82)**	**-2.963 (-10.78)**
Number of obs.	**18791**	**15147**	**15189**	**5486**	**10970**
R-squared	**.5352**	**.2742**	**.3279**	**.2509**	**.2285**
F-statistic	**1802.19**	**749.63**	**740.65**	**234.58**	**469.37**

CHAPTER 8: Future Research

The greatest limitation to the study is a result of a limitation in the data: the construction of the net worth variable. Net worth neglected to include pensions and the contribution that employees have made to the Social Security system. By not including pensions and potential Social Security benefits, I underestimate the accumulation of net worth (especially for those with lower levels of net worth in general) and overestimate the degree of wealth inequality. Furthermore, neglecting to include pensions and underestimates the value of long-term employee-employer relationships (for those pension plans that are not portable between employers). It is through increased length of tenure with the firm that these types of pensions grow with access to these pension funds being made contingent on the continued relationship between the worker and employer. Additionally, neglecting pensions and contributions to Social Security makes determining the degree of racial and gender inequality in society difficult to determine. That non-whites and females are in occupations and positions where pensions are non-existent would reflect that we have underestimated the degree of inequality since many males and Whites do have this asset yet it is unaccounted for. While we have overestimated the degree of inequality because Social Security is not included as an asset we may also think that Social Security, as an asset based on current earnings, is larger for both males and whites and as a result has led us to underestimate

the degree of inequality between the races and genders.

The findings of this research have interesting public policy implications. Certainly more research needs to be done in this area to determine whether tax credits and breaks given for acquiring additional education have a demonstrable affect on the level of wealth inequality. It would seem to be the case however that those who have very little wealth, by engaging in a future profitable investments in education, will also engage in a similarly profitable investment in specific human capital. This research overall has neglected to delve into why these investments have a positive rate of return. Perhaps those who have little wealth in actuality just have a low level of ability and that those with high levels of ability tend to remain in school and with their employer for a longer period of time and that what we are seeing in our results is the sole affect of ability on the rate of wealth accumulation. For these individuals, human capital is more than a capital good; rather it is also a consumption value.[29] Thus, beyond conducting further research that looks at to what degree an investment in human capital augments levels of wealth accumulation and why this rate of return is positive, we also need to turn to human capital research that looks to proxy variables such as years of education or work experience as more than just investments where the future discounted value of the benefits is compared to the costs but rather also as a good that individuals seek because either because of their ability, their family background, or for consumption purposes.

Thus what we have are results that describe the head of the primary economic unit in terms of all their assets and debts (with the notable exception of pensions and Social Security) and excludes about 1000 individuals who have total income that exceeds $973,000. Further research in this area would strive to remove these restrictions. Perhaps the easiest place to start would be by including the values pensions (which is information collected in the SCF) and estimating the value of the Social Security

[29] Gullason, Edward T. "The Consumption Value of Schooling." Journal of Human Resources. 24(Spring 1989). 287-298.

based on work history, earnings, and expectations for future labor market involvement. Not only would this allow us to estimate the effect specific human capital has on the rate of annual increase in unearned income but in all likelihood would yield results indicating a significantly lower level of wealth inequality between races and genders, would increase the coefficient on specific human capital in the net worth equation, yield a positive coefficient on the interaction term, and possibly decrease the coefficient on general human capital (since a large component of wealth is now determined by factors other than education).

The next step to improving the analysis would be to take all members of the primary economic unit instead of just the head of the unit or all members of the household. This would increase the total amount of net worth captured and allow for a greater number of females to be captured.

The final step would be to take the full sample and use the weighting system in interpreting the results. If the problems of inequality in accumulation of net worth between races and genders remained and the difference between the returns on either component of human capital remained large after all these steps, we might think that a more fundamental problem exists.

Concluding Remarks

We have reviewed the literature on human capital and found a fundamental gap in the research – monetary rewards in terms of wealth. Using the Survey of Consumer Finances and keeping in mind both the limitations of the data set and of the analysis, it appears that a greater investment in human capital coincides with a greater rate of annual wealth accumulation. Additionally, it was found that general human capital was related to increases in the rate of wealth accumulation at over double the rate than with a similar investment in specific human capital (28 percent versus 12 percent). This analysis however was lacking in determining why a general human capital was more valuable in terms of wealth than specific human capital. This research, however, sets up the framework for conducting additional research in human capital and its relationship to wealth accumulation.

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