AN INQUIRY INTO THE EFFECTS OF PERSONALITY VARIABLES ON THE ECONOMIC RETURN TO EDUCATION

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TO EDUCATION

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CHAPTER I

INTRODUCTION

In terms of economic considerations, investment in human capital is a long run labor supply decision that individuals make according to their labor market expectations. Being one of the major components of human capital, education has an important role in such a decision making process. Through education people gain certain skills, enhance their general qualities, and become more trainable workers. These factors increase their productivity making them better candidates in the labor supply pool. They also signal increased earnings, more job security, and better working conditions.

Nevertheless, obtaining these future benefits requires immediate pure costs as well as foregone earnings. Thus, before deciding whether to invest in a certain type and level of education, individuals consider all the long term benefits and costs that they face in the process. If they see that investing now means harvesting more in the future, evaluated in terms of current values, they would prefer receiving education.

Individuals and the environment in which they operate, however, are not homogenous. People have different abilities, personality traits, preferences, and other characteristics. They may not also have the same kinds of family and environment related backgrounds. Under such diverse circumstances, not only will the investment decisions that individuals make be different, but subsequent outcomes of the same type or level of the investments will also be different. Some people will find investing in

education more beneficial due to higher anticipated returns, while others may think the other way. Some individuals may not invest just because their resource constraints would not allow doing so.

In this study we will concentrate on the return to education investment, which relates earnings to additional years of formal schooling. There is a substantial literature dealing with the economic return to education. The contribution of this study to the previous research will come from its concentration on individual-specific characteristics, particularly personalities.

Especially in the last several years, lots of studies have linked the effects of personality traits to performance both in education and on the job. The evidence shows a significant relationship. However, personality variables have not yet found their way into the returns to education equations. The vast majority of the studies in the literature focus on the role of cognitive ability, measured by IQ or similar raw intelligence tests, in controlling for person-specific endowments. Yet, considering productive capacity and earnings, we know that cognitive ability is not the only thing that makes people similar to or different from one another.

We believe that incorporating personality variables into the earning equations could significantly increase the predictive ability of such specifications in determining the role of education.

Problem Statement:

A quite large number of studies show a significant relationship between personality traits and student achievement. Peterson and Carson (2000), Daugherty and

Lane (1999), Hill and Huntley (1998), Brownlow et al. (1997), and Brown (1994) are a few examples.

The possible effects of personality on job performance have also gotten close attention from many researchers. Stewart (1999) finds a consistent relationship between conscientiousness and employee performance. Caldwell and Burger (1998) state that personality traits play an important role even on the success rate of getting a desired particular job. Motowidlo et al. (1997) theorize and predict that personality differences which manifest themselves as various behaviors across individuals constitute a very large dimension of job performance. Costa (1996) and Wright et al. (1995) provide other examples that link personality to employee performance.

Given a relationship between personality variables and performance both in school and at work, we would expect that these variables could also affect the rates of return to education as well. Personality variables may affect earnings directly and/or through education. So, if a personality variable affects earnings only directly, ignoring personality variables in earnings equation should not cause a bias in the estimated values of education coefficients. However, if the various personality traits cause some people to derive more benefit from educational investment than others, then omission of the personality variables in earnings equation would result in biased estimates of the education coefficients.

Nevertheless, we see that such possible effects are neglected in the earning equations that try to determine the economic returns to education. This implies the possible presence of biased estimates in these specifications due to omitted personality variables.

Since it is possible that personality variables may affect earnings indirectly via schooling, or directly in after-school earnings, or some combination of these, the main issues that are addressed in this study are:

- whether there is an omitted personality bias in estimating the economic return to education

and,

- what would be possible direct effects of personality variables on labor market earnings.

Objectives of the Inquiry:

The development of human capital theory in the mid-1960s attracted tremendous attention to education and its effects on earnings. Probably, the cause of this attraction was not only the development of a famous theory. Rather, as many observers mention, especially the second half of 20th century was all about change. And economic change, directed by very important technological innovations, was faster than ever. Within this dynamic environment, formal education and its institutions substantially increased their importance in social, economic, and political spheres. Both the demand for and supply of education have become much more diverse and selective. Like educational institutions, most other institutions have also transformed themselves in conjunction with technological innovations. In the economy, the finance and service sectors have increased in relative importance. Rapid technological improvements have required well-educated and highly trained individuals, making them scarce and more valuable. Consequently, labor markets have generously and favorably rewarded those individuals.

Therefore, earning differentials between more educated and less educated individuals have widened dramatically, compared to past decades (Mankiw, 1998, p. 404).

So, within this environment, it is not surprising that many researchers have paid considerable attention to education and its implications. A lot of studies have asked these two basic questions: why do employers pay more to more educated people in the first place, and what exactly is the monetary payoff to education? Unanswered questions remain, however. Some models claim that the payoff, in fact, is due to individual characteristics as a package, not to education. Accordingly, education merely serves as a contract-broker between employees and employers. Still other models and researchers state that labor market imperfections were adversely and in most cases nonlinearly, or arbitrarily, affecting the outcome of the educational investment. Thus, the payoff was in fact to the internal, firm-specific education and training, rather than to the formal education that individuals acquire before entering the labor market.

Obviously, such models have greatly enhanced our understanding of labor markets and the various roles of education. However, within the skill-based, multidimensional world, these black-or-white type models fail to explain many important features of education.

On the other hand, *human capital theory* states that education increases earnings since it makes individuals more productive. If a person wants to earn more income in the future, he or she should gain skills and increase his/her productivity by investing in education now.

Within this context, many researchers have rigorously analyzed the impact of education on earnings. Nonetheless, the ongoing controversy in the literature indicates

that the issue of education's contribution to earnings has not yet been resolved. Much of the controversy is related to appropriate control for person-specific characteristics. However, the emphasis on adjustments for cognitive ability in returns to education specifications has overshadowed the importance of other person-specific characteristics. We believe that not only mental ability, but also personality traits affect individuals' performance and productivity. Thus, personality, being one of the fundamental determinants of human behavior, deserves closer attention.

The primary objective of this study is to determine the economic value of an additional year of schooling, after adjusting for the possible direct and indirect effects of personality variables. The results of this study should have important private and public policy implications. Having a more accurate information, both investor individuals and policy makers would have a chance to make better decisions about schooling.

As is mentioned above, personality traits have been found to have significant effects on job performance. To what degree, if any, this is reflected in earnings would be interesting to see. Thus, the secondary objective of the study is to see whether personality variables have an independent (from schooling) and direct effect on earnings. This information could give important clues about how performance or productivity is awarded in labor markets. It could also give us valuable information about the unexplained earning differentials observed in the labor markets.

Major Contributions of the Study:

Utilizing human capital theory, researchers have conducted many empirical studies. The vast majority of these studies have used earnings function type

specifications, as we do in this study. However, one of the most serious problems that researchers face has been the appropriate control for individual-specific characteristics, such as mental ability, family background, school quality, and ethnic/race differences. Each of these correlating effects has attracted considerable attention from researchers. Recently, twin studies have become popular in an effort to control for these individual differences.

Nevertheless, research considering personality differences as a determinant of economic returns to education has been next to nonexistent. Twin studies do not solve the problem because, "nonshared environmental effects can make genetically matched MZ twins dissimilar in behavior" (Rowe, 1997, p. 371). This means that identical twin studies should also consider the effects of nonshared environment and personal characteristics in their analyses. In today's world, tasks and responsibilities have become more complicated and diverse. Labor markets require more different kinds of skills and abilities than they used to require 50 years ago. More than ever before, some tasks require high levels of intelligence while others emphasize certain types of personal characteristics. Many occupations, particularly in the services sector, can be given as an example of the latter case. As noted earlier, empirical studies also show the effect of personal characteristics on job performance.

The primary contribution of this study is its inclusion of personality variables in the earnings function in order to determine economic return to education more precisely. Related to this principal purpose and contribution, we will also determine the possible direct impact of personality variables on earnings.

Our study will also complement previous research through its use of siblings data. Use of siblings data allow us to apply a better estimation technique making the analysis more accurate. Further, we rarely see studies that are able to use siblings or twins data sets and still have a rich choice of independent variables. As Chamberlain (1977, p. 294) states, however, "we should not assume a priori that there is no within-family variation in the left-out environmental variables" when we use twins. Thus, with the inclusion of all of the control variables available in the siblings data we use, we will be removing some of the shortcomings of similar studies.

Finally, another contribution of the study comes from its separate estimation of the earnings equation for males and females. Normally, researchers pool the data for both sexes and use a dummy variable to control for gender effect. This may not give as accurate estimates as separate estimates if there is any other variable in the equation correlating with the gender dummy.

Organization of the Inquiry:

The inquiry is organized into five additional chapters. The second chapter gives a review of the relevant theoretical and empirical literatures. The third chapter of the study introduces the theoretical model, its assumptions and its main implications. The fourth chapter develops and specifies the empirical model. That chapter also describes the estimation procedures, data, variables, and various regression equations. The fifth chapter of the study presents the empirical findings. Finally, the sixth chapter provides main conclusions, implications, and limitations of the inquiry, and concludes with suggestions for further research. The text also includes two appendixes. Appendix A

presents simple statistics and the correlation matrix for men. Appendix B gives simple statistics and the correlation matrix for women.

CHAPTER II

LITERATURE REVIEW

Review of Theoretical Literature:

There is no theoretical consensus on the effects of human capital and its dynamics. There are several competing theories that have been extensively analyzed in the literature. Still they vary in terms of their explanatory power and related empirical support. Below we will describe four of these competing theories that have had the most impact in explaining the effects of investment in human capital.

Neoclassical Theory:

Orthodox neoclassical economics has evolved from demand, supply, and the notion of competitive equilibrium. The theoretical framework of education and training that is explained within this context is referred to as the "neoclassical" theory. It mainly concerns the determinants of demand for and supply of skills, establishing a relationship between costs of acquiring marketable skills and subsequent returns. These costs are regarded as investments similar to that of investments made in physical capital. This approach led to the concept of *Human Capital.* The human capital approach and its appearance as a theory is primarily attributed to Becker's classic exposition (Marshall and Briggs, 1989, p.177).

The term 'Human Capital' is widely accepted today. Nevertheless, the use of 'capital' as a reference to 'human' was not universally accepted or welcomed in the mainstream literature when it first appeared in 1960s. As Becker (1993, p. 16) himself mentions, "many people were criticizing this term and the underlying analysis because they believed it treated people like slaves or machines". Now, however, almost no one sees anything wrong with considering non-physical endowments, such as education, ability, etc as *capital* "in the sense that they improve health, raise earnings, or add to a person's appreciation of literature over much of his or her lifetime" (Becker, 1993, p. 15). Consequently, in the past several decades, the concept of human capital has been a central theme of the research in the economics of education, and in the analysis of labor markets and earnings, income, employment, and many other areas (Woodhall, 1987).

Human capital theory views education as an investment for gaining skills and increasing productivity. Better skills and higher productivity are subsequently rewarded in the form of higher earnings in labor markets. Accordingly, individuals are assumed to invest in education up to the point where the present value of the cost of an additional investment is equal to the present value of the returns coming from that investment. These investment returns are the ultimate guide for individuals in deciding whether to undertake a particular type or level of education (Levin, 1987).

According to human capital theory, not only just formal schooling but also all other types of learning processes are considered as investments in human capital. Becker stresses this point as follow:

> "The conclusion must be that learning is a way to invest in human capital that is formally no different from education, on-the-job training, or other recognized investments. So it is a virtue rather

> than a defect of our formulation of costs and returns that learning is treated symmetrically with other investments. And there is no conflict between interpretations of the shape of earnings profiles based on learning theory and those based on investment in human capital because the former is a special case of the latter" (Becker, in Woodhall, 1987, p. 214)

Proponents of the human capital approach give most emphasis to the significance of education as the major determinant of productivity. Within this context, education is no longer considered as a consumption good, rather it is seen as a form of investment that individuals have to make in order to increase their potential in labor markets (McNabb, 1987).

As Marshall and Briggs (1989, p. 178) explain, human capital theory claims that it has consistent answers for the major puzzles that other various ad hoc theories fail to explain adequately. Some of these are as follow:

- earnings increase at a decreasing rate through the working life span
- the unemployment rate is inversely related to the level of productivity, or skills
- younger people receive or demand more education and training than older people
- people with more ability invest more in education
- within schooling groups, earnings tend to be distributed more asymmetrically as the schooling level increases.

Human capital theory claims to have no difficulty in explaining decreasing rates of income accumulation that are observed in the age-earnings profile of an individual. Accordingly, individuals invest heavily in human capital in early ages, sacrificing some earnings and bearing related costs. This is because they want to harvest benefits for a

longer period. In middle life, their earnings increase rather rapidly due to those earlier investments. In the latter stages of their earning span, earnings start to fall mostly for two reasons. First, the already high human capital stock depreciates rapidly and also becomes outdated. Second, they need to make new investments in human capital to stay on track. Compared to the middle life, this means additional costs in the later ages (Johnes, p. 12).

According to human capital theory, unemployment decreases as the productive ability of society increases. An individual's investment in human capital not only increases his/her own productivity, but also produces a spillover effect that enhances the knowledge and productivity level of other workers. Also, differences in income levels between countries reflect the differences in their accumulation of human capital and their application of it in an innovative way to promote growth. Thus, human capital accumulation is considered as an engine of growth as it enhances the productive ability of the society (Viesca, 1999).

Education is an integral part of the neoclassical theory of labor markets. Thus, the relationship between education and labor market earnings furnish an explanation that provides answers not only to the formation of the wage structure but also to the significance of public policies regarding the distribution of income. Accordingly, any such policy must include some sort of education planning that permits economically disadvantaged people to improve their educational attainments (McNabb, 1987).

Human capital theory considers some of the labor market abnormalities, such as gender and race wage differentials, as exogenous. Becker declares that the concept of discrimination in labor markets can be seen as a 'taste' for discrimination on the part of the discriminating employers as they pay a price for this privilege. If a taste for

discrimination is present, such employers act as if they were willing to pay funds for their action regardless of the knowledge that they may possess about the economic efficiency of the discriminated agent. So, unlike taste-oriented actions, discriminatory actions coming from ignorance or false information can be eliminated by removal of the false conceptions. (Febrero and Schwartz, 1995, p. 403-404).

Human capital theory has not been free from various criticisms. Most of these criticisms have been directed at the issue of the education-productivity relationship and the role of education in labor markets. Exactly how education increases productivity has became the center of controversy. As Woodhall states, most of the critics

> "have argued that education does not improve productivity by imparting necessary knowledge and skills, but simply acts as a screening device, which enables employers to identify individuals who posses either superior innate ability or certain personal characteristics, such as attitudes towards authority, punctuality, or motivation, which employers value and which are therefore rewarded by means of higher earnings" (Woodhall, 1987, p. 23).

In various alternative models, the presence of any causal relationship between education and productivity, upon which human capital theory is built, has been questioned rigorously. These alternative explanations are in general called *screening* models as we discuss below.

Screening Models and Education:

Groot and Hartog (1995) explain that *screening* theory refers to a range of models questioning the productivity-augmenting role of education in labor markets. The common term "screening" is generally used to imply two things: first, to point out that education is only a signal for pre-existing personal qualities; second, to indicate that

education merely serves as a screening device for employers. Groot and Hartog further explain that the "set of theories includes the filtering theory (Arrow, 1973), the screening theory (Stiglitz, 1975), and the signaling theory in the strict sense (Spence, 1973, 1974a, 1975b; Riley, 1976, 1979b)".

As Johnes (1993, p. 19) mentions, although the signaling model is a special version of the screening model, they do not imply same thing, especially with regard to the role of education.

The signaling model has the following major assumptions: (a) schooling does not affect productivity, since productivity is a person-specific phenomenon; (b) more costs are required to obtain more schooling, and more productive people have lower schooling costs; (c) information is asymmetric in markets: individuals are aware of their productive capacities, but firms are not; (d) no cost is necessary to observe individuals' educational qualifications. According to this model, firms use schooling qualifications in order to make hiring decisions and to set wages. They simply assume, however, that more productive individuals will have more schooling. To check whether this assumption is valid in the aggregate, firms use observable total output of the workforce as probabilistic information. Thus, if indeed more productive people choose more schooling, only then can an equilibrium exist. As is the case in the basic human capital model, individuals will invest in schooling only if the costs are less than or equal to the benefits. As investment costs will be lower for more productive individuals, they will find schooling worthwhile and subsequent wages sufficient. The reverse will be the case for less productive people. Thus, schooling will be acting as an effective tool to separate more productive individuals from less productive ones, but it will not make less productive

people more productive. Consequently, the firm's belief about the higher productivity-higher schooling level relationship would be confirmed (Groot and Hartog, 1995).

Then, if there is no productivity-augmenting effect of schooling the signaling model simply implies "that education serves no socially useful purpose; it raises the earnings of the educated, reduces those of the uneducated, and leaves output unaffected" (Johnes, 1993, p. 14).

While wages will be equal to the expected marginal productivity of workers in the signaling theory, in the screening model they are determined by observable individual characteristics, such as education. This is so because employers, at the time of hiring, do not yet know the productive capacity of employees. At this point employers just have some rational expectations, given credentials, about employees. Workers are assumed to be perfect substitutes and competition equates wages to marginal productivity (Groot and Hartog, 1995).

The screening model also concludes that education does not affect labor productivity; rather, it just sorts out individuals according to their certifications. The private value of education is restricted to the signaling effects that benefit signalers. While a strict case of the screening model argues that, in terms of social perspective, education is a waste of resources, a more relaxed version of the model gives some social credit to education as a means of allocating labor efficiently. Still, one of the major implications of the screening models is that if employers have other ways of determining the productivity levels of prospective employees, schooling would become less important and individuals would acquire less of it (Winkler, 1987).

Empirical studies of screening models are not convincing. The evidence is not strong enough to make these models appealing in explaining the role of human capital in labor markets. Nevertheless, screening models brought a considerable attention to the somewhat blurred area that seems to exist between education and earnings. The causality relationship between education and subsequent earnings is questioned rigorously due to the contributions of these models (Woodhall, 1995).

Winkler further describes the impact of screening models on the classical human capital concept as follow:

> "screening models pose a challenge to the more traditional human capital model as an explanation for the observations that individuals of higher ability tend to acquire more education and individuals with more education tend to receive higher pay. While the two models provide different explanations, the policy implications may not significantly differ. Furthermore, there is no convincing evidence to date showing the extent to which educational institutions screen for innate ability versus enhanced productive ability" (Winkler, 1987, p. 291).

Rather than dealing with the strict cases, it seems that screening models become more explanatory when they are considered in their more relaxed versions. In this way they become complements to the human capital theory, by just emphasizing the various roles of education. In turn, appreciation of the presence of these additional roles of education is in fact not contrary to the basic assumptions of the human capital theory.

Segmented Labor Markets and Education:

The concept of segmented labor markets evolved inductively by analyzing detailed data sets from various labor markets. This line of study showed that, especially

among nonwhites in the inner-city labor markets, the positive relationship between education and earnings did not always hold as human capital theory suggests. Furthermore, in typical ghetto-type labor markets, high unemployment levels were found to be persistent among people with high levels of education. On the basis of these studies, it is argued that in the real world markets operate significantly different from what the human capital theory describes (Marshall and Briggs, 1989, p. 192).

The dual labor market theory is one such hypothesis that describes the presence of segmented, self-contained labor markets. Accordingly, there are *primary* and *secondary* segments of workers and jobs in these markets. In the primary segment, workers get paid well, working conditions are good, there is job security and stable employment opportunities. In addition, rules and procedures related to employee promotion and allocation are well defined. In the secondary segment, however, the conditions are completely reversed (McNabb, 1987).

In the primary market, jobs are largely firm-specific and skills are acquired and advanced through on-the-job training. Thus, as the majority of the cost of such training is put on the employer, the payoff period for this investment is an increasing function of the length of worker tenure. Consequently, in order to minimize trained employee turnovers, firms in the primary segment pay wages typically higher than the marginal productivity of the worker (DeFreitas, 1995).

DeFreitas further explains that, within the primary market, wages are determined according to the firm's internal wage hierarchy, job performance and unwritten customary rules. Competitive external market forces have little or no influence on the process.

Both employers and employees benefit from maintaining such a stable employment relationship.

In the secondary market, however, providing specific training is uneconomical as the turnover rates on most jobs are high, the employment relationship is low, and worker discipline is not in order. It would be waste of resources trying to train employees with poor work habits and with short-term commitments. In order to ensure an adequate number of employees, the employer hires more workers than required and calls them as needed to replace quitting or absentee employees, or he simply employs those who show up each day. In fact, in these secondary segments the employer has no incentive to establish a stable employment relationship, given the job characteristics. Wages are determined according to this casual and fragile relationship. Low wages, high unemployment, and weak and unstable employment relationships are primary characteristics of the secondary markets (Marshall and Briggs, 1989, p. 196).

The dual labor market theory has important implications about the role of education in labor markets. Human capital accumulation through education does not have much significance, because each segment determines wages and employment by means of its own internal mechanisms. In addition, the special kind of employment relationship within each segment promotes different kinds of worker discipline and behavioral traits, making employee mobility between the segments extremely difficult. This type of labor market organization favors some individuals, but restricts others -such as women, minority groups, and secondary segment employees- in obtaining a primary segment job. The acquisition of further education does not help to become upwardly mobile between the segments. So, this interpretation of labor markets discredits a major

implication of the human capital theory that assumes supply-side policies of education would decrease earnings inequalities (McNabb, 1987).

In the internal labor markets, on-the-job training is the primary determinant of skill accumulation and wages are mostly attached to jobs rather than to persons who fill them. Education requirements of the firm mainly reflect average changes of general educational attainments. Rather than productivity concerns related to human capital factors, educational requirements are changed simply to ration available jobs. Thus, in this view, education serves solely as a screening device for employers to identify dependability, stability, reliability, and other desired characteristics of prospective employees (Hinchliffe, 1995).

The importance of the internal labor markets as an alternative to formal schooling is described by Doeringer as follows:

> "As in the nineteenth-century economy, education and training in internal labor markets is a ready substitute for that in schools, but schools are limited in their ability to substitute for internal labor markets. As recently as the mid-1980s, workforce surveys confirm that internal labor market training is of equal or greater importance than schooling for occupations ranging from production work to sales and administration (Doeringer, 1995, p. 30).

As for corrective policy implications, segmented or dual labor market theorists suggest that helping low-income individuals requires the integration of the secondary segments into the primary-segments. Any policy that fails to promote establishing the primary segment type employment relationships would not be effective in reducing income inequalities (Marshall and Briggs, 1989, p. 192).

The Radical Theory of the Labor Market:

The neo-Marxian theory of labor markets is referred as *radical* theory. These economists evaluate the nature of labor market processes in terms of the role of class and class conflict. Accordingly, a worker's class has two characteristics. First, the economic class exists as its presence is dictated by the social relation of production. People in a class share similar working conditions and economic fate. These working and economic conditions constitute the objective face of the class formation. Second, the presence of class also manifests itself in terms of some subjective criteria. These could be shared feelings of separateness and solidarity from other classes. Within the class, however, closer relationships could surface (Marshall and Briggs, 1989, p. 200).

The radical theory is, in fact, an alternative approach to the dual theory. Unlike the dual theory, however, the radical theory emphasizes class conflicts and the development of monopoly capitalism. According to the radical theory, employers, or capitalists, deliberately divide the labor force into identifiable self-contained groups with differing social and economic status in order to prevent formation of a widespread class-consciousness. This way, monopoly capitalism aims at maintaining control over production. In addition, within the complexity of large-scale production processes, segmentation also lets employers control and monitor one class with the use of an other class. As a consequence, large firms develop internal labor markets that are highly insensitive to outside competition (McNabb, 1987).

Radical theory also sees the role of education differently. Within this interpretation, education serves the capitalist objectives of promoting and maintaining class divisiveness. As the dominant capitalist class targets, the fragmentation of the labor

force becomes possible through various roles of educational institutions. Capitalists use the school system in maintaining class differences, and ,thus, the economic and social status quo. High-and-low income areas, having different schooling systems, promote the development of different student attitudes, which in turn are used to classify individuals in labor markets. Unlike the cognitive-skill oriented human capital theory, the radical theory gives a great deal of emphasis to the socialization role of schooling. In this sense, schools teach people to become obedient, punctual, and hierarchy-minded individuals. More than anyone else, capitalists benefit from this socialization role of education, as it reduces training costs and makes classification easier (Marshall and Briggs, 1989, p. 201).

In terms of corrective policies, the radical theory denies any benefit of traditional policies. Since both the education system and the segmented labor markets are used to maintain the status quo, the radicals argue that the traditional human capital policies of productivity-and-skill oriented remedies are virtually ineffective. The positions of the disadvantaged classes can only be made better off through a unified and heightened class-consciousness (McNabb, 1987).

As an ultimate remedy, the radicals declare that "any marginal gains workers might receive by increased education are far outweighed by the benefits they would receive from collectivizing the ownership of capital (Marshall and Briggs, 1989, p. 203).

Review of Empirical Literature:

The empirical literature analyzing the economic return to education has had quite a large number of issues to deal with. Since earnings and educational attainments are

influenced by many factors, determining the pure economic value of the schooling investment has been a challenging task for researchers. Unfortunately, past research can only explain less than half of the determinants of earnings. Furthermore, the exact contribution of education remains ambiguous.

In addition to considering other determinants, such as gender, experience, union membership, etc., the rate of return studies often concentrate on particular factors that are thought to be important interacting causal elements of education-earnings relationship. These major focus areas, in general, are family background, mental ability, school quality or expenses, and, in a very few cases, personality characteristics. Omission of any such set of variables could give biased education coefficient estimates in earnings equations.

The literature that analyzes the economic return to education by controlling most of this conventional set of variables generally finds around a 10 percent return to each year of additional schooling investment (Krueger and Lindahl, 2000) and (Miller et al., 1995). The range of findings, however, varies between as low as 5 percent and as high as 15 percent (Hartog, 1999).

In the next section, we will be concentrating on literature that investigates the effects of psycho-behavioral traits on earnings. These studies give a particular emphasis to the magnitude of the impact of schooling.

Personality Traits and Returns to Education:

Research considering personality variables in estimating schooling coefficients is extremely rare. This scarcity is in fact consistent with the limited use of psycho-behavioral variables in the other research areas in economics as well. Haveman and

Wolfe (1995) and Anderson et al. (1994) blame the unavailability of the required data. Darity and Goldsmith (1996) call attention to the neglect of 'the procedural view of human rationality' in economics. As Anderson, et al. (1994) mentions, however, studies that exclude psycho-behavioral variables in their analyses when they are relevant, produce biased estimates "because they erroneously assume that utility functions are identical across individuals." Filer (1986) also makes the same claim.

Fortunately, an increased interest towards the use of psycho-behavioral variables can be detected within the literature in recent years. In this regard, Bowles et al. (2000) study the puzzle behind the unexplained earnings differences across seemingly similar individuals. In terms of the determinants of labor market experiences, the authors address the following issues:

- Seemingly similar people receive very different earnings and conventional skill-and-education based explanations do not tell much why.
- Economic advantages of having successful parents seem to go beyond the effects of all kinds of inherited factors.
- Supposedly irrelevant personal characteristics are in fact strong indicators of earnings.

In dealing with these puzzles, the authors emphasize the concept of 'incentive-enhancing preferences' originally introduced in another study of Bowles and Gintis (1998). Incentive-enhancing preferences can be thought as individual qualities that employers value, but cannot be included in labor contracts. Accordingly, when the contracts governing the employment relationship are incomplete, employers care about employees' incentive-enhancing preferences, which would be higher among more

educated people. Effort, for example, is a non-contractible labor service that will be higher for the individuals who have lower disutility of labor. Disutility of labor would decrease as the education level of the individual increases. Since additional schooling increases the incentive-enhancing preferences of employees, it also increases their labor market value beyond the value of the cognitive skills obtained through education. In other words, in addition to the development of more skills, education supplies behaviorally more fitting individuals to the employers who otherwise would suffer from incompleteness of the labor contracts.

Though they empirically do not test their claims, Bowles et al. conclude that: (a) conventional variables can not explain most of the observed differences in earnings, (b) causality relationships in returns to education are still ambiguous: how schooling raises earnings remains controversial, and (c) cognitive differences do not seem important in understanding the unexplained variance in wage equations.

As to some degree supportive of the above claims, the authors also report a study of Osborne who incorporates some personality variables into the earnings equation. The estimates obtained from the National Longitudinal Survey of Young Women (NLSYW) and the National Child Development Study (NCDS) data sets show that a one standard deviation change in years of education, aggression, and withdrawal variables had the coefficients of 0.197, -0.068, and -0.034, respectively. Locus of control (externality) had the same sign and magnitude as the withdrawal variable. The IQ score had a coefficient of 0.021.

Using the data drawn from the National Longitudinal Survey of Youth (NYSY) study, Braatz (1999) compares the effects of affective traits and cognitive skills on

subsequent labor market experiences of young women. She finds that, regardless of schooling level, cognitive skills were a major determinant of earnings and the effects of affective traits were less important. Whether a woman works and how many hours she works were found to be influenced by self-esteem level.

Other than these recent attempts, especially in the last two decades we can not find 'returns to education' studies that incorporate psycho-behavioral variables into their analyses. We can find some earlier studies, however.

Among those, Jencks et al. (1979 pp. 122-153) study the effects of personality traits on earnings and on various background variables. The authors use data from the Talent and Kalamazoo Survey in their analyses. They use personality measures obtained through self-reports and assessments by others. They also construct indirect measures of personality, such as study and work habits, by use of behavioral surveys. Though the authors estimate the effects of different kinds of personality variables separately, they also combine all traits to obtain a single measure of personality. The effects of the combined noncognitive characteristics on occupational status and earnings were quite large. The total additive effect of noncognitive traits on earnings was 0.245, after controlling for education (0.098) and occupational status (0.142). The authors also recognize that "individuals with certain personality characteristics may also realize greater returns to ability or education than others." After testing for this, they find some interacting effects, but they were not large in magnitude. Still they encourage further research and suggest that different samplings and specifications could give stronger interacting effects.

Andrisani (1976) investigates the effects of internal-external attitudes on a number of aspects of labor market experience, with a particular reference to blacks and whites. The data come from the National Longitudinal Surveys of young and middle-aged men. By using the usual human capital model and controlling for education and most of the other conventional variables, the author finds that 'moderately internal' youth earn 12 percent more than 'moderately external' youth, in terms of two years-period hourly wages. Similar results were found for middle-aged men. Considering interracial differences in the returns to education and in the internal-external measures in the study, there is some suggestive evidence indicating the presence of attitude-education-earnings interactions. The size of the interacting effect, however, can not be determined from the available coefficients.

In an earlier study, Sewell and Hauser (1975, p. 185) analyze the education-earnings relationship in detail. By utilizing earlier waves of the Wisconsin Longitudinal Survey, the authors manage to incorporate some social-psychological factors in their analysis. These variables are: perceived expectations of significant others, educational and occupational aspirations, and high school rank. They find that 54% of the variance in post-secondary schooling was attributable to the combined social-psychological factors. The authors further explain the combined effects of these variables as follow:

> "because they also depend to a moderate degree on socioeconomic background and ability, the social psychological variables account for a substantial share of the effects of background and ability on schooling. The intervening social psychological variables account for 60% to 80% of the effects of the background variables on schooling and about 85% of the effect of ability on schooling" (Sewell and Hauser, 1975, p.186).

The social psychological factors also had a direct additive impact on occupational status (42.6%) and on earnings (7.6%), apart from the indirect effects mentioned above Sewell and Hauser (1975, p. 186).

Unfortunately, we see that the 'return to education' literature, per se, analyzing the effects of psycho-behavioral variables is not very enlightening. There is a limited number of studies considering the effects of personality variables on schooling coefficients in earnings equations. Yet, these studies fail to capture well-defined, comprehensive, and appropriately determined personality assessments. They incorporate only a few psycho-behavioral variables that apparently are not robust representatives of standardized personality assessments and classifications found in the literature of psychology. Furthermore, rather than having an integrated focus or purpose, leading to follow up, duplication, or subsequent comprehensive evaluation, these studies appear to be isolated cases, making valid generalized claims even more difficult.

This situation makes it quite clear that a lot more research is necessary in this area to really understand what is going on.

CHAPTER III

THEORETICAL FRAMEWORK

The theory of human capital describes a decision framework that people use accordingly in deciding whether to undertake a certain type or level of education and training. In this sense it is a *positive* theory. Even though there have been earlier analytical explanations, the first rigorous theoretical treatment of the concept was Becker's (1964) well-known study, *Human Capital.*

Human capital theory simply states that differences in individuals' personal characteristics are reflected in their labor market productivity and are awarded accordingly. For example, other things being equal, the more educated will be able to produce more and, thus, earn more than the less educated. So, people who possess more favorable personal qualities will have higher earnings potentials.

The human capital investment model is generally introduced by use of the present value concept. We follow Johnes (1993, p. 6) and Fleisher and Kniesner (1980, p. 269) to explain the basic theoretical framework.

Let us assume that Y is an occupation that an individual procures after investing in education, and X is another occupation that does not require any such education. Also let i be the discount or interest rate, and j be the time period (in years). The base period $j = 0$ represents the present time or beginning period of the schooling, for which an investment is being considered. Also assume t is the point at which schooling investment is

completed and entry to the labor force commences. Further, τ is end of the earnings span. Then, in terms of present values of X and Y occupations we have,

$$PV_x = \sum_{j=0}^{\tau} X_j (1 + i)^{-j} \quad (1)$$

$$PV_y = \sum_{j=0}^{\tau} Y_j (1 + i)^{-j} \quad (2)$$

In dealing with human capital decisions, decisions based on the internal rate of return, r, the interest rate at which $PV_y = PV_x$, is often convenient:

$$\sum_{j=0}^{\tau} (Y_j - X_j)(1 + r)^{-j} = 0 \quad (3)$$

The rate of return is higher the smaller the cost of acquiring Y, the greater the difference in net earnings between Y and X, and the longer the positive earnings span related to Y.

If we separate the periods into when the investment occurs, from 0 to t, and when the earnings stream takes place, from t to τ, then equation (3) can be rewritten as,

$$\sum_{j=0}^{t} (X_j - Y_j)(1 + r)^{-j+t} = \sum_{j=t}^{\tau} (Y_j - X_j)(1+r)^{-j+t} \quad (4)$$

If $C_j = X_j - Y_j$ and $R_j = Y_j - X_j$, expressing equation (4) in continuous form and solving for r yields,

$$\int_0^{\tau} (R_j - C_j) e^{-rj} \, dj = 0 \quad (5)$$

As Psacharopoulos (1981) states, if the returns to education were constant over time, the age-earnings profiles last to infinity, and the only cost of schooling is the foregone earnings, then equation (5) implies that individuals invest in education up to the point where the net present values of costs and returns are equal. In the other words, this particular discount rate, r, is the lowest rate of return that an individual would need to

earn in order to be better off because of the investment. This rate of return and the market interest rate should be compared in deciding to undertake a schooling investment. The investment would be considered beneficial if the internal rate of return is higher than the interest rate on other investments (the market rate).

Johnes further explains a number of major theoretical implications of the model as follows:

All other things being equal,

- The greater the earning span between t and τ, the greater the return. This implies that the earlier the investment is made, the greater the subsequent earnings differential.
- The lower the foregone earnings, C_j, the greater is the investment undertaken.
- The higher the R_j, the more investment will be made. In addition, as the earning differences between investing and non-investing groups of workers increase, demand for investing in education would also increase.
- The higher the rate of return, r, the higher the demand for education. This is due to increased net present value of future earnings.
- In order for any level of education to be procured, the rate of return to that level of education must be positive and greater than the rate of return on the next best alternative.

The model also allows for obtaining demand and supply curves for an individual to invest in a certain level of education.

Chiswick and Chiswick (1987) show that the marginal rate of return (MRR) on investment constitutes a demand (for funds) schedule, that is downward sloping under the

assumptions of diminishing returns and increasing opportunity costs. The marginal (interest) cost of funds (MCF) used to finance those investments, on the other hand, is related to a supply (of funds) schedule which is upward sloping, as more funds are available only at higher costs.

The supply curve will shift to the right or to the left depending upon the factors that make financing education easier or harder. A favorable family wealth, for example, would shift the supply curve of the individual to the right. The demand curve, however, would shift for reasons related to individual differences, such as mental ability, or learning capacity (Fleisher and Kniesher, 1980, p. 281).

Labor market equilibrium implications of the human capital theory can be summarized in three points. The equilibrium wage rate is determined by labor supply and demand. Thus, first of all, in order for any investment to be undertaken, an individual must be paid sufficiently high lifetime wages. This would determine the supply side of the investment decision. Second, more educated employees should be more productive, so that employers would provide any additional required wage premium for such individuals. This determines the demand side hiring and payment decisions. Third, with regard to lifetime earnings, individuals with any level of schooling should be compensated such that they would have no incentive to change their current investments in education. This would ensure long-term competitive labor market equilibrium (Bai, 1999).

The theory of human capital suggests that individual differences affect both the amount of investment made and subsequent returns to that investment. Considering this, it is easy to see that the inclusion of personality variables into the model fits quite well as

they cause performance differentials among individuals both in school and in the work place. The empirical evidence of this claim is discussed elsewhere in this study.

In a technical sense, the mechanism through which personality variables could affect returns to education would be similar to that of mental ability, or intelligence. That is to say, because they possess additional favorable personality traits, some people benefit more from schooling as they have better chances of obtaining higher paying occupations in the future. These higher chances and returns are due to their higher productive capacities, rather than some random effects or reasons. Thus, all other things remaining equal, individuals having favorable personality characteristics will invest more in education and derive greater marginal benefits from it.

CHAPTER IV

EMPIRICAL MODEL

The first section of this chapter presents the empirical model specification. The second section describes our hypothetical expectations towards the effects of the personality variables within the model. The third section introduces the data and the prospective variables to be used in estimating the regression equations. Finally, the fourth section shows the estimation procedures and related regression equations.

Model Specification:

Based on the human capital theory, an 'earnings function' estimation technique is the most widely used procedure in the rate of return to education literature. Though generally attributed to Mincer's (1974) extended work, initial derivations of the relationship go back to Becker (1964), and Becker and Chiswick (1966).

Chiswick (1997) describes several major desirable features of a 'human capital earnings function' (HCEF) as follows:

- Derived from an identity, it is not an ad hoc fitting regression. The coefficients have economic interpretations.
- Less heteroskedastic residual variance and more normally distributed residuals can be obtained by using the natural logarithm of earnings as a dependent variable.

- The HCE function allows for the easy insertion of additional variables into the equation for specific purposes.
- It can be efficiently used for various data sets.
- Its coefficients facilitate making comparisons and detecting relationships across time, space, and units.

The earnings function approach, however, also has some disadvantages. First, issues about incorporating various costs causes problems, especially in social rates of return estimates. Second, it underestimates returns to primary schooling because of the automatic inclusion of foregone earnings, even for that level of education. The HCE function is further criticized for some of its assumptions, stated in Chapter III, but most of the literature still considers them highly realistic (Psacharopoulos, 1981).

Following Chiswick (1997), the human capital earnings function exclusively for the schooling variable can be derived as shown below:

Let,

Y_0 = earnings with zero years of schooling

Y_t = annual earnings after investing in t years of formal schooling

C_t = amount of investment in year t of schooling

r_t = rate of return in year t of schooling *(i.e.,* $r_t=Y_t-Y_{t-1}/Y_{t-1}$*)*

$K_t = (C_d + C_f) / Y_{t-1}$ where C_d = direct and C_f = foregone cost components, K_t is the ratio of investment to the potential income in the initial period if there were no further investment. It can be thought as the individualized intensity of the investment. $K_t = 1$ when $C_d = 0$ *and* $C_f = Y_{t-1}$, or $C_d + C_f = Y_{t-1}$.

If only one year of schooling is completed, earnings after this first period are:

$$Y_1 = Y_0 + r_1 C_1 = Y_0 + r_1 K_1 Y_0 = Y_0 (1 + r_1 K_1) \quad (1)$$

After the second year,

$$Y_2 = Y_1 + r_2 C_2 = Y_1 + r_2 K_2 Y_1 = Y_1 (1 + r_2 K_2) = Y_0 (1 + r_1 K_1)(1 + r_2 K_2) \quad (2)$$

Following the same pattern,

$$Y_s = Y_0 \prod_{t=1}^{s} (1 + r_t K_t), \quad (3)$$

where S is the number of schooling years completed.

Taking natural logarithms yields,

$$\mathrm{Ln} Y_s = \mathrm{Ln} Y_0 + \sum_{t=1}^{s} \mathrm{Ln}\,(1 + r_t K_t). \quad (4)$$

If $r_t K_t$ is small (i.e., less than .2229), then $Ln(1 + r_t K_t) \cong r_t K_t$. So,

$$\mathrm{Ln} Y_s = \mathrm{Ln} Y_0 + \sum_{t=1}^{s} (r_t K_t) \quad (5)$$

Assuming $r_0 = r_t$ and $K_0 = K_t$ for all t,

$$\mathrm{Ln} Y_s = \mathrm{Ln} Y_0 + (r_0 K_0) S \quad (6)$$

The estimated coefficient of S in equation (6) is the average percent increase in earnings per year of extra schooling. rK is the rate of return from schooling, implying that K also should be accounted for. If the coefficient of S *(i.e., α)* is estimated and K is known, the rate of return is $r = \alpha / K$.

If, for example, the opportunity costs were 80% of a full year's potential earnings, Y_{t-1}, and the remaining 20% direct costs were funded with part-time work, then $C_t = Y_{t-1}$ meaning that $K = 1$. In earnings equations, direct costs are generally not incorporated mostly for data and practical reasons. $K = 1$ is a general assumption in the literature. If we also assume that direct costs are cancelled out by part-time earnings, etc., then $r = \alpha$ in equation (6).

Thus, *the rate of return*, or relative change in earnings *(∂LnY)* due to an additional year of schooling *(∂S)* is given by,

$$\alpha = \frac{\partial \mathrm{LnY}}{\partial \mathrm{S}} = \mathrm{r}. \tag{7}$$

Given this basic rate of return derivation, we can proceed to construct our empirical framework for siblings data.

In Judge, et al. (1988, p. 490), Mundlak states that in most cases the unobserved individual characteristics are likely correlated with observable time-varying attributes. If this is suspected to be the case, then, use of a fixed-effects model is preferred over other specifications.

Ashenfelter and Rouse (1999), Ashenfelter and Zimmerman (1997), and Altonji and Dunn (1996a,b) are most recent notable studies that use siblings data in estimating returns to schooling. Relying on the examples from these studies, the following empirical model can be derived:

Let Y_{ij} and S_{ij} be the log of wages and the schooling level, respectively, of the i^{th} brother in the j^{th} family,

$$\mathrm{Y_{ij}} = \alpha \mathrm{S_{ij}} + \alpha_1 \mathrm{X_j} + \nu_j + \varepsilon_{ij} \qquad \mathrm{i} = 1, 2 \; ; \mathrm{j} = 1, 2, \ldots, \mathrm{J} \tag{8}$$

In equation (8), X_j is observed characteristics of the family j, and ν_j, ε_{ij} are family-and-person-specific error terms, respectively. They may vary in terms of intercepts or slope coefficients. The error component ν_j varies across families, but does not vary for individuals within a family.

Differencing equation (8) for $i = 1, 2$, eliminates the family effect and provides a obtaining fixed-effects (within-family) estimator,

$$Y_{2j} - Y_{1j} = \alpha S_{2j} - \alpha S_{1j} + \varepsilon_{2j} - \varepsilon_{1j}$$

$$= \alpha [(S_{2j} - S_{1j})] + \varepsilon_{2j} - \varepsilon_{1j} \quad (9)$$

In order to test whether the returns to schooling change because of the personality characteristics, we can estimate an equation with an *interaction* term between the siblings' personality variables and their schooling differences. The measured personality variables are extraversion, openness to experience, neuroticism, conscientiousness, and agreeableness. Grouped and individual effects will be considered. With the inclusion of the measured personality variables, P_{ij}, and a vector of other observed individual-specific characteristics, Z_{ij}, into the equation (8), we would have,

$$Y_{ij} = \alpha S_{ij} + \alpha_1 X_j + \alpha_2 Z_{ij} + \alpha_3 P_{ij} + \alpha_4 S_{ij} P_{ij} + \nu_j + \varepsilon_{ij} \quad (10)$$

As Chaplin (1997, p. 875) states, an interaction effect exists "when the main effects of one independent variable are different at different levels of a second independent variable". In equation (10) we would expect that the main effects of S_{ij} may be different at different levels of P_{ij} variables. Presence of such a relationship is captured by the interaction term $S_{ij}P_{ij}$.

A *level* equation can also be constructed assuming that there is no interaction between education and personality variables, namely,

$$Y_{ij} = \alpha S_{ij} + \alpha_1 X_j + \alpha_2 Z_{ij} + \alpha_3 P_{ij} + \nu_j + \varepsilon_{ij} . \quad (11)$$

Similarly to what we did in equation (9), if we let D be the 'sibling difference' operator, then equation (10) gives the fixed-effects specification as,

$$DY_{ij} = \alpha DS_{ij} + \alpha_2 DZ_{ij} + \alpha_3 DP_{ij} + \alpha_4 D(S_{ij}P_{ij}) + D\varepsilon_{ij} . \quad (12)$$

Obviously, the same procedure can be readily applied to equation (11), as well, to obtain only the level, or direct, effects. This *level* fixed-effects equation would be:

$$DY_{ij} = \alpha DS_{ij} + \alpha_2 DZ_{ij} + \alpha_3 DP_{ij} + D\varepsilon_{ij} . \quad (13)$$

As is mentioned above, unlike ε_{ij}, the error term ν_j is constant for individuals within the family and thus will not be correlated with the explanatory variables in equations (12) and (13). This permits us to control for unobserved family-specific factors.

We will estimate not only the fixed-effects level and interaction equations, but also estimate equations (10) and (11) to take advantage of various estimation procedures.

Data and Variable Description:

The data will be drawn from the Wisconsin Longitudinal Study (WLS). The WLS is a 40-year study of a random sample of 10,317 men and women graduated from Wisconsin high schools in 1957. Survey data were collected in 1957, 1964, 1975, and 1992/93. For various reasons, the sample sizes vary among these studies, however. Most of the respondents were born in 1939. In addition to these original respondents, in 1977 and in 1993/94, separate data waves were collected from a randomly selected sibling of the original respondents. The majority of these siblings were born between 1930 and 1948. Even though all of the original respondents graduated from high school, about 7 percent of their siblings did not complete a high school education. For the original respondent, we will use the 1992/93 data release. This release contains 8,493 individuals. For the siblings, the 1993/94 release will be used. This release contains 4,804 siblings. About 49.5 percent of the sample were men and 50.5 percent were women. These data were collected by Hauser, et al. via telephone and mail surveys.

The WLS cohort of men and women mainly represents white Americans (66%) who mostly completed at least a high school education. The rest (34%) are composed of African-American, Hispanic, or Asian respondents. The African-American strata of American society is under-represented. About 19 percent of the WLS sample came from farms. A more comprehensive description of the WLS study can be found in Hauser et al. (1993).

These collected data provide a substantial amount of information about economic and social background, schooling, labor market experiences, family formation, social participation, youthful aspirations, mental and physical health, psychological state, and military service.

To assure the data quality, a substantial amount of care and effort were undertaken during every phase of the longitudinal surveying process. Hauser et al. put it this way:

> "The WLS is widely recognized as one of the most useful bodies of longitudinal data on the lives of Americans because of the quality of the survey measurements (and our efforts to measure that quality), extremely high retention of panel members, complete, multi-layered documentation of the data, and multiple linkages to personal and institutional records" (Hauser et al. (1993), p. 4).

Personality variables that we are closely interested in were collected, based on the Five- Factor Model of Personality Structure. Also known as the Big Five, these characteristics are extraversion, openness to experience, neuroticism, conscientiousness, and agreeableness. There is quite a lot of praise about the representative power of this set of factors, especially in the literature of psychology. Wiggins and Trapnell (1997, p. 737), for example, describe this as "a 'working consensus' among a substantial number

of investigators on the primary importance of the dimensions of" these personality structures.

Hauser et al., researchers implementing the WLS study, further emphasize this point as follows

> "By assessing the Big Five, we will be in the unique position to conduct the largest personality assessment of midlife adults; to replicate earlier work on the factorial structure of personality using a more heterogeneous sample, and to link variations in personality functioning to social structure across the life course. It should be noted that the WLS has long been viewed as unique in its linkage of personality and social structural factors. With recent advances in personality assessment, it is now possible to use state-of-the-art instruments to gather comprehensive information about enduring personality traits and examine their relations to life course trajectories of occupational attainment (Hauser et al., 1993, p. 13).

Undoubtedly, this widespread trust of the Big Five increases our confidence about the representative ability of the personality variables that we will be using in the inquiry.

Below we will introduce these five-factor personality variables in order to clarify their literature-based meanings. However, first of all, let's briefly describe what the term *personality* means.

Hughes et al. (1993, p. 146) state that the term personality has been used to describe two different things. First, it refers to the way an individual is perceived by others. This meaning reflects an assessment of one person in the eyes of other people. Second, the term personality also refers to an individual's inner nature. This second meaning emphasizes why an individual behaves in a certain way. Accordingly, people behave in a regular, certain manner because they have particular characteristics, or traits. These particular traits as attributes of persons mostly determine behavior. The Five-Factor personality structure is based on the second meaning.

Brief Definitions of the Five-factor Personality Variables:

Extraversion versus Introversion: As a personality trait, extraversion correlates with various behaviors. Unlike introverts, extraverts do not show socially inhibited behavior (Hauser et al., 1993, p. 12). Watson and Clark further explain certain aspects of such people as follows:

> "recent models...emphasize that extraverts are happy, enthusiastic, confident, active, and energetic. More fundamentally, it now appears that Extraversion essentially taps individual differences in affectively rewarding performance: compared to introverts, extraverts view themselves as more effectively and pleasurably engaged in various aspects of their lives" (Watson and Clark, 1997, p. 788).

Agreeableness versus Antagonism: The agreeableness trait "reflects essentially prosocial characteristics, describing the person who is emphatic and makes an effort to establish positive relationships with others" (Hauser et al., 1993, p. 12). Further, "Agreeableness is probably best conceptualized as a general latent variable that summarizes more specific tendencies and behaviors (e.g. being kind, considerate, likable, cooperative, helpful)" (Graziano and Eisenberg, 1997, p. 795).

Conscientiousness: The conscientiousness trait refers to "the multiple elements of persistence and impulse control in task and achievement settings (Hauser et al., 1993, p. 12). Conscientious people are observed to be dependable, responsible, organized, persistent, reliable, and to have a sense of direction. Also, they tend to be moderate, careful, and consistent in evaluating their own interpersonal style (Hogan and Ones, 1997, p. 865).

Neuroticism: The neuroticism trait "reflects multiple elements of emotionality, such as nervous tension, fearfulness, and brittleness under stress" (Hauser et al., 1993, p. 12). Similarly, people with the neuroticism trait tend to be insecure, emotionally unstable, envious, jealous, temperamental, high-strung, and emotional (Watson and Clark, 1997, p. 781).

Openness to experience: To describe this personality trait, researchers make a distinction between people who are tolerant, imaginative, flexible, sensitive, inquisitive, empathic and others who are rigid, practical, dogmatic, and down-to-earth. Open individuals appear to be more receptive and tolerant to various ideas and experiences (McCrae and Costa, 1997, p. 842).

Variables for Regression Equations:

From the data described above, we constructed a subsample by matching the male siblings with the original male respondents, and female siblings with the original female respondents. Thus, male-female (cross-gender) siblings were eliminated from our sample. Observations having missing values and the extreme values that show abnormality, or threaten the approximate normal distribution assumption were also excluded from the sample. Self-employed people and people who did not hold a job within the last 12 months were also eliminated from the sample. After these adjustments, our sample sizes for men and women were 814 and 842 individuals, respectively.

Below we introduce all of the variables that will be used in our various regression equations. For convenience in future use, conventional, personality, and interaction distinctions will be made in introducing them. Information about variable means,

standard deviations, minimum and maximum values and correlation matrices can be found in Appendixes A and B for men and women, respectively.

Conventional Variables:

Lnincome: log yearly income received in wages, salaries, commissions, and tips before taxes and other deductions.

Education: years of formal education completed.

Experience: experience is calculated as [age - (years of schooling + 6)]. Though it has some disadvantages, this way of calculating experience became rather standard especially after Mincer's (1974) well-known study.

Experience2: experience * experience.

IQscore: IQ scores come from the Weschler Adult Intelligence Scale (WAIS). However, only 10 out of 14 WAIS questions were asked in the survey.

Unionmemb: union membership, 1 = yes.

Married: marriage status, 1 = currently married.

Parentincome: parents' total income, obtained from Wisconsin tax data.

Fatheredu: years of father's education.

Motheredu: years of mother's education.

Personality Variables:

The personality variables *Extraversion, Agreeableness, Conscientiousness, Neuroticism, and Openness* are described above. These are continuous variables measured on a 1 to 36 total score basis. They are assessed by the Big Five Inventory (BFI-54).

Interaction Variables:

The interaction variables are obtained by multiplying the education variable with each of the personality variables:

Eduextraversion = Education*Extraversion

Eduagreeableness = Education*Agreeablenes

Educonscientiousness = Education*Conscientiousness

Eduneuroticism = Education*Neuroticism

Eduopenness = Education*Openness.

Relationship of the Personality Variables to Education and Earnings:

Our reasons for including the personality variables in the earnings equation in determining the economic impact of education are given elsewhere in this study. Given the model above, in this section we will explain the possible relationship between the personality variables, education, and earnings.

As it might be clear by now, our fundamental purpose in this study is to determine the economic value of educational investment as precisely as possible. In this context, we believe that personality variables can play two kinds of roles in earnings equations. First, they have a direct influence on earnings. This effect would be independent of education. Second, they have an indirect effect on earnings. In this case personality variables are moderators between education and earnings. For example, the return to education may increase as openness to experience increases. Obviously, there is no reason for these two kinds of roles to be mutually exclusive.

So, if the personality variables are directly related to earnings, we expect the following relationships between the dependent variable *income* and independent

personality variables:

- As we describe in the previous section, the *extraversion* variable mainly refers to more expressive and energetic features of human behavior. People with these features may be more productive compared to introverts. However, such features may not always relate to productivity. With caution, we expect the extraversion variable to positively affect earnings.
- *Agreeableness* is an indication of positive, cooperative, and constructive behavior. In today's highly interpersonal work environment, agreeableness can be productivity-augmenting. Thus, it is expected to positively affect earnings.
- Compared to the other personality variables, the *conscientiousness* variable is more closely related to task and achievement factors. Conscientious people are highly persistent, organized, and dependable. Such individuals should be more productive and, therefore, earn more.
- *Neuroticism* mostly correlates with nervous tension, envy, jealousy, and temperamental and emotional types of behaviors. Since these are in general an indication of unstable behavior, the neuroticism trait would probably adversely affect efficiency and productivity. However, envious, jealous kinds of correlating characteristics can also stimulate effort. Still, we expect that the neuroticism variable would be negatively related to earnings.
- Our final independent personality variable is *openness*. It refers to the kinds of individuals who are eager to experience new things. They are imaginative and creative, and like change. We expect that openness is positively related to earnings.

If an interaction is present between personality variables and education, the rate of increase of the earnings with education will be driven upward or downward by a personality variable, depending on its sign and magnitude. As the research cited earlier indicates, personality traits affect both student performance and labor productivity. This implies that the coefficient of education variable might be sensitive to the inclusion of the personality variables into the earnings equation. Having said that, we can proceed to explain the following relationships with regard to interacting effects:

For convenience, instead of equation (12) let us use equation (10) to obtain the total effect of education on earnings. If we take the related partial derivation in equation (10) then, the increase in the mean income, $E(Y_{ij})$, for each 1-year increase in education is given by,

$\alpha + \alpha_4 P_{ij}$, where P_{ij} is one of the five personality variables.

For extraversion, agreeableness, conscientiousness, and openness variables, we expect α_4 to be positive. For the neuroticism variable we expect α_4 to be negative. There is no reason to expect different signs in direct and interactive effects. So, the total impact of the education variable, S_{ij}, on income, $E(Y_{ij})$, would be higher or lower depending on the sign of α_4 and the magnitude of P_{ij}. If the interaction effect is not present, the impact of education is captured only by α.

Estimation Procedures and Regression Equations:

On the basis of the human capital theory, our goal is to estimate the empirical model described above to determine the effects of personality variables on the economic return to education. To achieve this goal, various estimation procedures are applied to

the data by using SAS software. We will estimate equations for male and female siblings separately. So, same-sex siblings will be matched and the following procedures will be conducted for both genders:

First, equation (13) will be estimated by excluding the personality variables. We will call this regression equation an estimate with *conventional* variables. Then the same equation will be estimated by including all five of the personality variables. This will be called the *level* equation estimate. The lack of an interaction term makes it a level equation, mostly terminologically. If personality variables do not give reasonably high *t*-statistics even in the level estimates, further estimates to capture *interaction* effects do not seem reasonable. Thus, as a final step, equation (12) will be estimated to include only those personality variables that give significant, or close to significant, results in the level estimates.

So, our regression equation with only conventional variables will be:

$$\begin{aligned} lnincome = {} & \alpha + \alpha_1\,\text{education} + \alpha_2\,\text{experience} + \alpha_3\,\text{experience2} \\ & + \alpha_4\,\text{IQscore} + \alpha_5\,\text{unionmemb} + \alpha_6\,\text{married}. \end{aligned} \tag{14}$$

Given (14), the level regression equation is:

$$\begin{aligned} lnincome = {} & \alpha + \alpha_1\,\text{education} + \alpha_2\,\text{experience} + \alpha_3\,\text{experience2} \\ & + \alpha_4\,\text{IQscore} + \alpha_5\,\text{unionmemb} + \alpha_6\,\text{married} + \alpha_7\,\text{extraversion} \\ & + \alpha_8\,\text{agreeableness} + \alpha_9\,\text{conscientiousness} + \alpha_{10}\,\text{neuroticism} \\ & + \alpha_{11}\,\text{openness}, \end{aligned} \tag{15}$$

and the interaction regression equation is given by,

$$\begin{aligned} lnincome = {} & \alpha + \alpha_1\,\text{education} + \alpha_2\,\text{experience} + \alpha_3\,\text{experience2} \\ & + \alpha_4\,\text{IQscore} + \alpha_5\,\text{unionmemb} + \alpha_6\,\text{married} + \alpha_7\,\text{extraversion} \end{aligned}$$

$$+ \alpha_8 \text{agreeableness} + \alpha_9 \text{conscientiousness} + \alpha_{10} \text{neuroticism} + \alpha_{11} \text{openness}$$

$$+ \alpha_{12} \text{eduextraversion} + \alpha_{13} \text{eduagreeableness} + \alpha_{14} \text{educonscientiousness}$$

$$+ \alpha_{15} \text{eduneuroticism} + \alpha_{16} \text{eduopenness}. \quad (16)$$

In addition to the fixed-effects regression equations above, equations (10) and (11) will also be estimated by using OLS, GLS, and FGLS procedures. This means stacking the siblings, instead of differencing them. Family background variables should also be included into these regression equations. As we did in the fixed-effects model, three different regression equations will be estimated by using these three estimators.

So, the regression equations for each of these three estimators are as follows. First, the regression equation with conventional variables is given by,

$$\textit{lnincome} = \alpha + \alpha_1 \text{ education} + \alpha_2 \text{ experience} + \alpha_3 \text{ experience2}$$

$$+ \alpha_4 \text{IQscore} + \alpha_5 \text{unionmemb} + \alpha_6 \text{married} + \alpha_7 \text{parentincome}$$

$$+ \alpha_8 \text{fatheredu} + \alpha_9 \text{motheredu} \quad (17)$$

Given (17), the level regression equation is:

$$\textit{lnincome} = \alpha + \alpha_1 \text{ education} + \alpha_2 \text{ experience} + \alpha_3 \text{ experience2}$$

$$+ \alpha_4 \text{IQscore} + \alpha_5 \text{unionmemb} + \alpha_6 \text{married} + \alpha_7 \text{parentincome}$$

$$+ \alpha_8 \text{fatheredu} + \alpha_9 \text{motheredu} + \alpha_{10} \text{extraversion} + \alpha_{11} \text{agreeableness}$$

$$+ \alpha_{12} \text{conscientiousness} + \alpha_{13} \text{neuroticism} + \alpha_{14} \text{openness} \quad (18)$$

and , finally, the interaction regression equation would be:

$$\textit{lnincome} = \alpha + \alpha_1 \text{ education} + \alpha_2 \text{ experience} + \alpha_3 \text{ experience2}$$

$$+ \alpha_4 \text{IQscore} + \alpha_5 \text{unionmemb} + \alpha_6 \text{married} + \alpha_7 \text{parentincome}$$

$$+ \alpha_8 \text{fatheredu} + \alpha_9 \text{ motheredu} + \alpha_{10} \text{ extraversion} + \alpha_{11} \text{ agreeableness}$$

$$+ \alpha_{12} \text{conscientiousness} + \alpha_{13} \text{neuroticism} + \alpha_{14} \text{openness}$$

$$+ \alpha_{15}\,\text{eduextraversion} + \alpha_{16}\,\text{eduagreeableness} + \alpha_{17}\,\text{educonscientiousness}$$

$$+ \alpha_{18}\,\text{eduneuroticism} + \alpha_{19}\,\text{eduopenness}. \qquad (19)$$

As is the case in the fixed-effects regression equations, interaction equation (19) will be estimated using only the personality variable(s) that give reasonably high *t* values when equation (18) is estimated.

In order to see the possible individual effects of the personality variables, regression equations (15) and (18) will also be estimated by using a personality variable(s) which produces highest *t* value in equation (14) estimates. However, only the coefficient estimates with the OLS and FGLS procedures will be reported. The fixed-effects and GLS estimates will be presented in an appendix to Chapter V.

The FGLS procedure is applied when the exact form of the heteroskedasticity is unknown. In general, researchers who use a GLS estimator do not also apply the FGLS procedure. However, as Kennedy (1996, pp. 114-127) describes, in some cases the cause of violation of the CLR assumption that disturbances are homoskedastic may not be appropriately determined. In such cases, application of FGLS procedure is advised. As we are going to discuss in the next subsection, the White's test did not show presence of heteroskedasticity in our sample, but we still think the application of the FGLS estimator would be beneficial for the reason just mentioned. It would also give us more comparative advantage in analyzing the data.

Diagnostic Tests:

We conducted the necessary tests to assess the outcome of our statistical and econometric applications. Since we applied various models for both men and women and

used quite a number of variables, some of the statistical indicators will be presented at the end of the study in Appendixes A and B. Here, various diagnostic applications will be presented.

The issue of a normal distribution is of less concern for large samples, i.e. 30 observations or more (McClave and Dietrich, 1994, p. 281). Still we checked the sample for normality. For the variables used, the means were equal or close to the medians, and the interquartile ranges were close to 1.33 times the standard deviations, indicating the presence of approximately normal distributions.

Heteroskedasticity is one of the most commonly encountered issues in cross-sectional data sets like ours (Johnston and DiNardo, 1997, p. 162). The White's test was applied to test for heteroskedasticity. Under the null hypothesis of homoskedastic disturbances, we concluded that heteroskedasticity is not present.

As Kennedy (1996, p. 177) explains, multicollinearity in a data set may arise for a variety of reasons, such as the existence of "some kind of approximate relationship among some of the regressors". Given five kinds of personality variables, the possible presence of collinearity was closely monitored. We used the *COLLIN* option in SAS to test for collinearity and the *TOL* option to obtain the tolerance values of the parameter estimates. These indicate that collinearity is not a problem. We also further examined any possibility of existence of multicollinearity by dropping various variables and checking for any significant changes in t statistics.

Incorrect regressors, changing parameters, and nonlinearity are other possible violations of the CLR model assumptions (Kennedy, 1996, p. 91). We used the SPEC option in SAS to test for correct model specification. The results indicated the models

were correctly specified. However, our comfort on these kinds of issues mostly comes from the fact that in this study we are closely following the foot-steps of the large volume of past research. The term 'conventional variables' that we use in many occasions in the study in fact reflects a well-established tradition about the model specification with earnings function. Therefore, if we keep a careful eye on the behavior of our non-conventional personality variables, there should not be a problem to worry about.

CHAPTER V

RESULTS AND ANALYSIS

This chapter presents the estimated results for both men and women. As we discussed in the previous chapter, four estimation procedures were used for three different regression equations. In some cases we replace the conventional equation with a level equation. For the sake of a clear presentation, the results of each estimation procedure with three regression equations will be given in different subsections. This will give the reader a chance to compare male and female estimation results for a given procedure.

Empirical Results:

Fixed-Effects Estimates for Men and Women:

The main results of the fixed-effect estimates for men are given in Table 1. We present the estimated coefficients of the regression equations (14), (15), and (16), respectively. Columns (2) and (3) present the estimation results for only the conventional variables. In sibling or twin studies, these are the variables that most of the researchers consider when they estimate the economic return to education with an earnings equation. In pure cross-sectional studies, however, family background variables are also considered as they are not eliminated by the model specification. The results in column (2) are

comparable to those of the previous studies. The education coefficient (0.10357), in particular, corresponds to the mean value of past estimates. As we mentioned previously,

Table 1. - Fixed-Effects Model -- (Men)
(Standard Errors in Parentheses)

	Conventional (eq. 14)		Level (eq. 15)		Interaction (eq. 16)	
Variable	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Education	0.10357 (0.01657)	0.0001	0.10406 (0.01670)	0.0001	0.10489 (0.01671)	0.0001
Experience	0.03978 (0.04367)	0.3630	0.04394 (0.04412)	0.3200	0.04021 (0.04388)	0.3601
Experience2	-0.00074 (0.00064)	0.2549	-0.00079 (0.00065)	0.2248	-0.00074 (0.00065)	0.2563
IQscore	0.01846 (0.01001)	0.0658	0.01847 (0.01007)	0.0673	0.01857 (0.01003)	0.0647
Unionmemb	0.12991 (0.08575)	0.1306	0.11794 (0.08655)	0.1738	0.12281 (0.08630)	0.1555
Married	-0.14152 (0.08443)	0.0945	-0.134440 (0.08513)	0.1152	-0.14101 (0.08504)	0.0981
Extraversion			0.00150 (0.00674)	0.8245		
Agreeableness			0.00298 (0.00851)	0.7261		
Conscientiousness			0.00808 (0.00856)	0.3455		
Neuroticism			0.00926 (0.00771)	0.2309	0.00615	0.3901
Openness			0.00089 (0.00887)	0.9204		
Eduneuroticism					0.00023 (0.00228)	0.9183
R^2 :	0.1408		0.1456		0.1424	
N=407						

in general, the estimated education coefficient has ranged from 5 to 15 percent. However, estimates plus or minus one or two points outside of this range also appear in some cases. A highly cited twin-study paper of Ashenfelter and Krueger (1996), for example, finds as high as 16 percent contribution of a year of education to earnings. Another twin-study of Behrman et al. (1980, p. 174), on the other hand, found as low as 3 percent return to education. So, considering only conventional variables, our estimated education coefficient for men is right in the middle of the mainstream findings.

Columns (4) and (5) in Table 1 contain the estimated coefficient results of the level regression equation (15). These are the coefficients of the conventional variables plus five personality variables for men. The education coefficient is 0.10406 and almost unchanged. The personality variables, however, did not perform well. Almost all of them have very high p-values. Only the conscientiousness and neuroticism variables have somewhat lower p-values, but they still are well above statistical significance levels. The non-significant estimated coefficients imply that we could not find sufficient evidence that shows a relationship between these personality variables and labor market earnings of men. Of course, these results for men do not confirm our expectation that personality variables are effective in determining earnings.

We estimated the regression equation (14) to capture any interaction effect that may be present between education and personality variables. That is to say, we wanted to see if personality variables were sharing any of the effect of the schooling variable in determining earnings. It was reasonable to estimate this equation if any of the personality variables were directly affecting the earnings in the first place. As we mentioned before, this interaction regression equation was going to be estimated to include only those

personality variable(s) with a significant or reasonably high *t* values when they are estimated in the level equation, equation (15). So, we ran this regression equation to include only the neuroticism variable and its interaction with education. The results in Table 1 indicate that no interaction effect is present. The neuroticism variable was not statistically significant in the level estimates, also, but the interaction estimation gives even higher p-values.

Table 2 gives fixed-effect estimation results for women. Again, we first present the coefficient estimates related to the conventional variables (columns 2 and 3). The estimated results for women are quite different from those for men. The coefficient of education for women, 0.15621, is about 5 percent higher than the estimated education coefficient for men. This result has some mixed implications.

Human capital theory states that if the earnings span is shorter, economic gains from investing in education will be lower. As Marshall and Briggs (1989, p. 567) explain, this has been the case for women as they devote more of their time to the household, compared to men. However, this trend has been declining in recent years and women have increased their earnings span for a variety of social and market related reasons. This may imply an upward shift of returns to education for women.
In terms of empirical analysis, the current evidence is not that assuring in terms of direct comparisons of economic returns to education for men and women. The fact that, on average, women earn less than men is well documented. However, in terms of the earnings function specifications, rates of return to education comparisons between men and women are still not conclusively abundant. In fact, they are scarce. In addition, it

seems there is an estimation issue, too. In general, studies that pool the data for men and women to estimate the economic return to education do not pay attention to whether the

Table 2. - Fixed-Effects Model -- (Women)
(Standard Errors in Parentheses)

	Conventional (eq. 14)		Level (eq. 15)		Interaction (eq. 16)	
Variable	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Education	0.15621 (0.01618)	0.0001	0.15696 (0.01618)	0.0001	0.15367 (0.01617)	0.0001
Experience	0.14669 (0.06156)	0.0176	0.14641 (0.06173)	0.0182	0.15821 (0.06158)	0.0105
Experience2	-0.00197 (0.00091)	0.0305	-0.00198 (0.00091)	0.0310	-0.00214 (0.00091)	0.0192
IQscore	0.00830 (0.01174)	0.4798	0.00874 (0.01185)	0.4609	0.00815 (0.01170)	0.4862
Unionmemb	0.02723 (0.08654)	0.7532	0.03937 (0.08693)	0.6509	0.04244 (0.08667)	0.6246
Married	0.04758 (0.08179)	0.5611	0.05940 (0.08224)	0.4706	0.04388 (0.08155)	0.5908
Extraversion			-0.00931 (0.00655)	0.1558		
Agreeableness			0.00341 (0.00825)	0.6794		
Conscientiousness			0.01473 (0.00855)	0.0856	0.01216 (0.00796)	0.1276
Neuroticism			0.01213 (0.00755)	0.1089		
Openness			0.00505 (0.00722)	0.4844		
Educonscientiousness					0.00420 (0.00253)	0.0975
R^2:	0.1898		0.2035		0.1993	
N=421						

statistical outcomes are the same for the two groups. In fact, for whatever reason, if the education and gender-dummy variables correlate in the earning equations, then, the estimated education coefficient could be biased. For this reason, when pooled samples of men and women are used, an education-gender interaction variable should be included in the earnings equation. Otherwise, we are implicitly assuming that the rate of return to education for men and women are the same, which may not be the case.

Despite these issues, our finding of higher returns for women is comparable to some other studies. Altonji and Dunn (1996), for example, find higher returns to education for women than for men. Kane and Rouse (1995) also find higher returns to a year of college education for women. Miller et al. (1997), on the other hand, estimate around 1.5 percent higher returns to education for men.

In the second set of columns in Table 2 we present results from equation (15) for women. The education coefficient (0.15696) in the level estimation is almost same as the education coefficient in the conventional estimation. As for personality variables, only conscientiousness has a significant coefficient (0.01473) with a p-value of 0.0856. The positive sign of this coefficient indicates that conscientious women earn more income, holding all other variables constant. More specifically, for each 1-point increase in the conscientiousness score, there is a 1.47 percent corresponding increase in the earnings of women. The estimated coefficient (0.01213) of the neuroticism variable also has a somewhat low p-value, (0.1089), but it can not be considered significant at the 10% level.

In the final set of columns in Table 2, estimated results from the interaction regression equation are presented. In this case, the estimated education coefficient of 0.15367 is slightly lower than the previous estimates. Here, the estimated coefficient

(0.01216) of the conscientiousness variable is no longer significant with a p-value of 0.1276. Nevertheless, the conscientiousness variable's interaction with education is significant at the 10% level. The interaction variable educonscientiousness has a coefficient of 0.00420 and a p-value of 0.0975. Even though the magnitude of the effect seems small, this result has some important implications.

To minimize any possible confusion, let us explain one of the main implications in some detail:

From equation (16), the interaction regression equation with regard to the conscientiousness variable would be,

$$\textit{lnincome} = \alpha + \alpha_1 \text{ education} + \alpha_2 \text{ experience} + \alpha_3 \text{ experience2}$$
$$+ \alpha_4 \text{ IQscore} + \alpha_5 \text{ unionmemb} + \alpha_6 \text{ married} + \alpha_7 \text{ conscientiousness}$$
$$+ \alpha_8 \text{ educonscientiousness (= education * conscientiousness)}$$

So, in terms of our main consideration, the estimated coefficients imply that the economic return to education is no longer given by the constant α_1, but determined by the term, $\alpha_1 + \alpha_8 \textit{conscientiousness}$. That is, the amount that women's income increases for each 1-year increase in education is dependent on the conscientiousness score. This means that the two variables, education and conscientiousness, interact to affect income. Thus, for example, the estimated rate of change of income for a year increase in education (one additional year of investment) for a 0.67 mean conscientiousness score is,

Estimated education slope = $\alpha_1 + \alpha_8 \textit{conscientiousness}$ = 0.15367 + 0.00420 (0.67) = 0.15648. The mean and following values, however, comes from the fixed-effects data and should be interpreted accordingly. With the maximum observed conscientiousness score of 14, the estimated education slope equals 0.21247. With the

minimum observed conscientiousness score of -15, the slope is 0.09067. In other words, we estimate that the income of women with the lowest conscientiousness score will increase by only 0.09067 for every additional year of education. This is less than half of 0.21247, the impact on the income of women with the highest conscientiousness score.

Rather than using these maximum and minimum values, the impact of moderately distributed conscientiousness scores can also be analyzed. Our sample distribution indicates that 68 percent of the conscientiousness scores fall between -5.03 and 6.37 range. So, -5.03 and 6.37 scores show moderately unconscientious and moderately conscientious individuals, respectively. Given these scores, the estimated education slope for moderately unconscientious women equals 0.13254. For moderately conscientious women it equals 0.18042. We see that the difference is about 5 percent.

As we can see, depending upon the conscientiousness scores of women, the magnitude of the economic return to education changes dramatically. Clearly, ignoring such an interaction effect in the earnings function specifications may cause biased estimates of returns to education.

GLS Estimates for Men and Women:

Table 3 shows the estimated results for men obtained with the GLS procedure. Since this is a pure cross-sectional estimation, we included family background variables also in order to capture possible family influences. We did not need these variables in the fixed-effects equations, however.

In the first set of columns in Table 3, the estimated coefficients with only conventional variables are presented. The GLS estimate of the education coefficient,

Table 3. - GLS (Standard Errors in Parentheses) -- (Men)

	Conventional (eq. 17)		Level (eq. 18)		Interaction (eq. 19)	
Variable	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Education	0.07574 (0.01148)	0.0001	0.07616 (0.01148)	0.0001	0.08859 (0.07368)	0.2296
Experience	0.06796 (0.02900)	0.0194	0.07287 (0.02911)	0.0125	0.06902 (0.02898)	0.0175
Experience2	-0.00101 (0.00043)	0.0187	-0.00107 (0.00043)	0.0125	-0.00102 (0.00043)	0.0167
IQscore	0.00083 (0.00687)	0.9035	0.00178 (0.00690)	0.7968	0.00119 (0.00687)	0.8624
Unionmemb	0.09222 (0.06055)	0.1282	0.09087 (0.06066)	0.1345	0.09445 (0.06064)	0.1197
Married	-0.10114 (0.06185)	0.1024	-0.08553 (0.06066)	0.1693	-0.08967 (0.08155)	0.1493
Parentincome	-0.00013 (0.00084)	0.8771	-0.00023 (0.00084)	0.7844	-0.00016 (0.00084)	0.8457
Fatheredu	0.00234 (0.00862)	0.7859	0.00257 (0.00864)	0.7665	0.00182 (0.00861)	0.8324
Motheredu	0.00773 (0.00973)	0.4273	0.00862 (0.00973)	0.3758	0.00792 (0.00972)	0.4154
Extraversion			-0.00473 (0.00473)	0.3178		
Agreeableness			0.00432 (0.00603)	0.4742		
Conscientiousness			0.01287 (0.00614)	0.0365	0.01723 (0.03492)	0.6218
Neuroticism			0.00734 (0.00565)	0.1943		
Openness			0.00014 (0.00579)	0.9811		
Educonscientiousness					-0.00047 (0.00253)	0.8540
Intercept	8.09495 (0.57051)	0.0001	7.47397 (0.66174)	0.0001	7.58497 (1.15300)	0.0001
N=814, R^2:	0.0692		0.0770		0.0736	

0.07574, is almost 3 points lower than that of the fixed-effects estimate. This is generally the case in other studies, also (e.g. see Ashenfelter and Krueger, 1994). The main reason for this difference would be related to differences in the ability of the two procedures in capturing background effects, especially family influences. The more background effects are captured in the equations estimated with GLS, the closer the results should be. The same thing would be true for OLS and FGLS estimates, in comparison to the fixed-effects estimates. The insignificant family background coefficients show that the related variables did not capture any possible influence of family endowments such as parental income and education. One of the principal advantages of the fixed-effects model would be its ability to take care of these kinds of variations.

Table 3 also presents results from the level regression equation (18). The estimated education coefficient is 0.07616. In terms of personality variables, only conscientiousness is significant, with a 0.01287 coefficient and 0.0365 p-value. With the positive sign, this result for men indicates that each one unit increase in the conscientiousness variable causes earnings to rise about 1.3 percent, holding everything else constant.

In the third set of columns in Table 3 we give results for the interaction regression equation. The education variable has a coefficient of 0.08859 and p-value of 0.2296. The coefficients of the personality variable, conscientiousness, and its interaction with education are not significant. Further, in the GLS procedure for men, the inclusion of the interaction term significantly increases the standard error of the education variable, making it statistically insignificant.

Table 4 presents results for women. In the first set of columns, the estimated

Table 4. - GLS (Standard Errors in Parentheses)-- (Women)

	Conventional (eq. 17)		Level (eq. 18)		Interaction (eq. 19)	
Variable	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Education	0.11055 (0.01165)	0.0001	0.11180 (0.01170)	0.0001	0.10003 (0.03644)	0.0062
Experience	0.04360 (0.04193)	0.2987	0.04325 (0.04205)	0.3040	0.04255 (0.04192)	0.3105
Experience2	-0.00054 (0.00063)	0.3888	-0.00053 (0.00063)	0.3945	-0.00052 (0.00063)	0.4044
IQscore	0.01274 (0.00716)	0.0754	0.01334 (0.00718)	0.0635	0.01319 (0.00716)	0.0658
Unionmemb	0.03102 (0.06464)	0.6315	0.02743 (0.06499)	0.6731	0.02431 (0.06473)	0.7073
Married	-0.00206 (0.06001)	0.9726	0.00808 (0.06055)	0.8938	0.00647 (0.06026)	0.9145
Parentincome	0.00147 (0.00082)	0.0743	0.00145 (0.00082)	0.0779	0.00146 (0.00082)	0.0756
Fatheredu	- 0.00175 (0.00922)	0.8495	-0.00172 (0.00924)	0.8525	-0.00194 (0.00922)	0.8335
Motheredu	0.01242 (0.01020)	0.2237	0.01211 (0.00973)	0.2367	0.01235 (0.01021)	0.2267
Extraversion			-0.00095 (0.00493)	0.8481		
Agreeableness			-0.00313 (0.00617)	0.6118		
Conscientiousness			0.00417 (0.00620)	0.5012		
Neuroticism			0.00841 (0.00550)	0.1266	-0.00150 (0.03072)	0.9612
Openness			0.00058 (0.00528)	0.9123		
Eduneuroticism					0.00073 (0.00222)	0.7430
Intercept	7.59883 (0.77322)	0.0001	7.42154 (0.82483)	0.0001	7.61480 (0.89574)	0.0001
N=842, R^2:	0.1165		0.1201		0.1195	

coefficients from regression equation (17) are listed. As was the case in the fixed-effects estimates, the GLS estimates are also higher for women, compared to men. However, within the equations for women, the GLS estimates are lower than the fixed-effects estimates. As we mentioned previously, this difference may be due to the varying abilities of the two estimation procedures in capturing the background variables, such as family effects. Within these conventional variables, the estimated coefficient of the education is 0.011055 with a p-value of 0.0001. This result is almost identical to Rouse's (1999) GLS estimate of the education coefficient for twins. Her sample, however, is pooled to include both males and females.

The second set of columns in Table 4 shows level regression estimates for women. Education has a coefficient of 0.11180 and a p-value of 0.0001. Within the personality variables, only the coefficient (0.00841) of the neuroticism variable could come close to being significant at 10% level, with a p-value of 0.1266. This was also the case in the fixed-effects estimates. As we will see below, the FGLS procedure gives a statistically significant coefficient. So, the captured relationship seems to be robust. However, interestingly enough, the sign of this coefficient is positive, in contrast to our expectation. Neurotic people are observed to be tense, envious, jealous, temperamental, high-strung, emotional etc. It is highly unlikely that such behaviors would positively affect earnings. In one way of reasoning, it can be thought that being jealous, for example, may lead to stimulation of effort, which in turn would cause an individual to work harder and earn more. Unfortunately, other than speculating in similar ways, we do not have a reasonable explanation for the estimated positive relationship between the neuroticism variable and earnings.

The final set of columns in Table 4 presents results from the interaction regression equation. The estimated education coefficient is 0.10003, with an observed significance level of 0.0062. Even though the interaction coefficient is not significant, this education coefficient is about one point lower than the conventional and level estimates.

OLS Estimates for Men and Women:

In Table 5 we present estimated results for men based on OLS estimates. For both the OLS and FGLS estimation procedures in tables 5, 6, 7, and 8, the results from a level regression equation only will be presented in columns (2) and (3), unlike the previous tables which presented conventional estimates in these columns. This equation contains conventional variables plus only one personality variable. The choice of this personality variable is based on the estimated values of equation (18). We include the personality variable that has the most significant or highest estimated *t* value. This gives us the opportunity to see the effect of a single personality variable in a separate equation. This equation will also be called a *level* equation with a reference to the related personality variable. The same thing was also done with the fixed-effects and GLS procedures but we preferred reporting only the coefficient estimates of conventional regression equations in order to see the differences between the standard and other estimates.

So, the second column of Table 5 presents estimated coefficients from the level equation with a conscientiousness variable. The coefficient of education is 0.07515 with a p-value of 0.0001. This result is very close to the GLS estimates. The personality variable, conscientiousness, has a coefficient of 0.01091 and p-value of 0.0524. This

Table 5. - OLS (Standard Errors in Parentheses) -- (Men)

	Level (eq. 18/Consci)		Level (eq. 18)		Interaction (eq. 19)	
Variable	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Education	0.07515 (0.01149)	0.0001	0.07611 (0.01151)	0.0001	0.08891 (0.07385)	0.2290
Experience	0.06898 (0.02900)	0.0175	0.07284 (0.02912)	0.0126	0.06903 (0.02899)	0.0175
Experience2	-0.00102 (0.00043)	0.0168	-0.00107 (0.00043)	0.0126	-0.00102 (0.00043)	0.0168
IQscore	0.00121 (0.00687)	0.8605	0.00176 (0.00690)	0.7989	0.00118 (0.00687)	0.8638
Unionmemb	0.09362 (0.06044)	0.1218	0.09081 (0.06065)	0.1347	0.09442 (0.06063)	0.1198
Married	-0.08922 (0.06201)	0.1506	-0.08445 (0.06218)	0.1748	-0.08858 (0.06214)	0.1544
Parentincome	-0.00017 (0.00084)	0.8433	-0.00023 (0.00084)	0.7857	-0.00016 (0.00084)	0.8479
Fatheredu	0.00195 (0.00861)	0.8209	0.00264 (0.00864)	0.7597	0.00190 (0.00862)	0.8257
Motheredu	0.00796 (0.00971)	0.4124	0.00860 (0.00973)	0.3771	0.00790 (0.00972)	0.4167
Extraversion			-0.00473 (0.00473)	0.3198		
Agreeableness			0.00432 (0.00603)	0.4740		
Conscientiousness	0.01091 (0.00562)	0.0524	0.01287 (0.00614)	0.0364	0.01742 (0.03497)	0.6185
Neuroticism			0.00730 (0.00565)	0.1963		
Openness			0.00011 (0.00579)	0.9845		
Educonscientiousness					-0.00048 (0.00254)	0.8504
Intercept	7.76533 (0.59412)	0.0001	7.47448 (0.66169)	0.0001	7.57865 (1.15424)	0.0001
N=814, R^2:	0.0731		0.0766		0.0732	

means that earnings of men increase around one percent for each additional conscientiousness score.

In the second set of columns in Table 5, the estimated coefficients obtained from equation (18) are given. The estimated coefficient of education is 0.07611, about 1 point higher than the preceding result. Among the personality variables, only conscientiousness is significant at a 5% level, with a coefficient of 0.01287. This coefficient is also slightly higher than the one cited above.

In the last set of columns in Table 5, the results from the interaction regression equation are reported. The education coefficient is 0.08891, but it is not statistically significant anymore. The interaction term educonscientiousness has a negative sign and a high standard error. These outcomes imply that the inclusion of the interaction term caused some problems, possibly collinearity.

In Table 6 we present the OLS estimation results for women. The first column shows estimated coefficients of the level equation with the neuroticism variable. The coefficient of education (0.11070) is about the same as GLS estimates for women. The neuroticism variable has a coefficient of 0.00811 with an observed significance level of 0.1084. This result is not conclusive enough to make an inference about the impact of the neuroticism variable.

In the middle columns in Table 6, the estimated coefficients from equation (18) are given. The coefficient of education is 0.11104 with an observed significance level of 0.0001. There is no significant estimated coefficient within the personality variables of women. We see that the OLS estimation performed slightly worse than the GLS estimator.

Table 6. - OLS (Standard Errors in Parenthesis) -- (Women)

	Level (eq. 18/Neuro)		Level (eq. 18)		Interaction (eq. 19)	
Variable	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Education	0.11070 (0.01178)	0.0001	0.11104 (0.01183)	0.0001	0.09955 (0.03684)	0.0070
Experience	0.03569 (0.04245)	0.4007	0.03678 (0.04263)	0.3885	0.03603 (0.04248)	0.3966
Experience2	-0.00042 (0.00063)	0.5013	-0.00044 (0.00063)	0.4866	-0.00043 (0.00063)	0.4983
IQscore	0.01333 (0.00716)	0.0631	0.01350 (0.00719)	0.0608	0.01341 (0.00717)	0.0618
Unionmemb	0.02288 (0.06478)	0.7240	0.02519 (0.06510)	0.6988	0.02260 (0.06482)	0.7274
Married	0.00707 (0.06019)	0.9065	0.00789 (0.06057)	0.8964	0.00646 (0.06026)	0.9147
Parentincome	0.00148 (0.00082)	0.0719	0.00147 (0.00082)	0.0748	0.00148 (0.00082)	0.0725
Fatheredu	- 0.00116 (0.00922)	0.8997	-0.00103 (0.00925)	0.9110	-0.00122 (0.00923)	0.8950
Motheredu	0.01201 (0.01021)	0.2297	0.01197 (0.01025)	0.2434	0.01215 (0.01022)	0.2348
Extraversion			-0.00060 (0.00493)	0.9035		
Agreeableness			-0.00289 (0.00618)	0.6405		
Conscientiousness			0.00337 (0.00621)	0.5871		
Neuroticism	0.00811 (0.00504)	0.1084	0.00797 (0.00550)	0.1478	-0.00164 (0.03093)	0.9578
Openness			0.00023 (0.00528)	0.9656		
Eduneuroticism					0.00072 (0.00225)	0.7495
Intercept	7.58331 (0.79238)	0.0001	7.55471 (0.83987)	0.0001	7.72643 (0.91069)	0.0001
N=842, R^2:	0.1169		0.1174		0.1170	

In the final set of columns in Table 6 results from the interaction equation are presented. The education coefficient (0.09955) is lower than it is in level estimates. It has an observed significance level of 0.0070. The coefficients of the neuroticism and eduneuroticism variables have quite high standard errors.

FGLS Estimates for Men and Women:

In Table 7, the FGLS estimation results for men are presented. The first set of columns in the table shows estimates from a level equation with the conscientiousness variable. The coefficient of education is 0.07115 and has an observed significance level of 0.0001. This estimated coefficient is slightly lower than the previous cross-sectional estimates. It is also about three points lower than the fixed-effects estimates. The personality variable, conscientiousness, has a coefficient of 0.01275. It is significant at 5% level. This estimate further supports the OLS and GLS results that the conscientiousness variable directly affects earnings.

In the middle of Table 7 results from a level equation with all personality variables are listed. The coefficient of education, 0.07230, remains about the same. Also, once again, the only significant personality coefficient for men is conscientiousness, with an estimated value of 0.01294.

In the final two columns in Table 7 we give results from the interaction regression equation. As we see, inclusion of the interaction term inflates the standard error of the education variable. Obviously, this implies that the conscientiousness and education variables do not interact to affect earnings for men.

Table 7. - FGLS (Standard Errors in Parentheses) -- (Men)

	Level (eq. 18/Consci)		Level (eq. 18)		Interaction (eq. 19)	
Variable	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Education	0.07115 (0.01103)	0.0001	0.07230 (0.01151)	0.0001	0.07984 (0.07864)	0.3103
Experience	0.06661 (0.02189)	0.0024	0.07005 (0.02216)	0.0016	0.06652 (0.02192)	0.0025
Experience2	-0.00104 (0.00031)	0.0009	-0.00108 (0.00032)	0.0006	-0.00104 (0.00031)	0.0009
IQscore	0.00328 (0.00635)	0.6051	0.00378 (0.00641)	0.5557	0.00324 (0.00636)	0.6104
Unionmemb	0.07190 (0.05007)	0.1514	0.07266 (0.05048)	0.1504	0.07229 (0.05022)	0.1504
Married	-0.11685 (0.05613)	0.0377	-0.11801 (0.05626)	0.0362	-0.11639 (0.05631)	0.0391
Parentincome	-0.00045 (0.00078)	0.5618	-0.00042 (0.00084)	0.5904	-0.00045 (0,00078)	0.5634
Fatheredu	0.00439 (0.00813)	0.5896	0.00424 (0.00814)	0.6025	0.00190 (0.00862)	0.5958
Motheredu	0.00670 (0.00934)	0.4738	0.00688 (0.00937)	0.4630	0.00668 (0.00935)	0.4750
Extraversion			-0.00267 (0.00473)	0.5722		
Agreeableness			0.00585 (0.00607)	0.3356		
Conscientiousness	0.01275 (0.00594)	0.0320	0.01294 (0.00655)	0.0485	0.01673 (0.03618)	0.6439
Neuroticism			0.00313 (0.00531)	0.5561		
Openness			-0.00455 (0.00563)	0.4188		
Educonscientiousness					-0.00029 (0.00258)	0.9113
Intercept	7.88736 (0.50645)	0.0001	7.73424 (0.58350)	0.0001	7.77005 (1.16793)	0.0001
N=814, R^2:	0.9960		0.9960		0.9960	

The FGLS estimates for women are presented in Table 8. The first set of results is from a level equation with a neuroticism variable. The coefficient of education is 0.11285 and is highly comparable to the OLS and GLS estimates. The personality variable, neuroticism, has a coefficient of 0.00878. It is significant at the 10% level. In contrast to our expectations, however, its sign is positive. So, accordingly, it has a positive impact on women's earnings. This was also the case in the GLS estimates. We will further discuss the possible implications of these results in the next chapter.

The estimated results from regression equation (18) are given in the middle of Table 8. The coefficient of education is 0.11323 and is again highly significant. The only significant personality variable, neuroticism, has a coefficient of 0.01040.

In the third set of columns in Table 8 we list the estimated results obtained from equation (19). The coefficient of education still remains highly significant. The interaction term, eduneuroticism, shows almost no variation within the regression. This obviously indicates that the neuroticism variable only directly influences earnings of women, not by interacting with education.

Overall, for both men and women, the estimation results indicate that our personality variables as a group are not important determinants of earnings. In all cases the joint tests of the personality variables failed to reject the null hypothesis. Individually, however, for both men and women the conscientiousness variable gives significant estimated coefficients in most of the estimation procedures. As we cited in chapter I, conscientiousness is also found to be a significant determinant of performance in the workplace. For women, surprisingly, the neuroticism variable also seems to have a direct positive impact on earnings. The implications of this finding will be discussed in

Table 8. - FGLS (Standard Errors in Parentheses) -- (Women)

	Level (eq. 18/Neuro)		Level (eq. 18)		Interaction (eq. 19)	
Variable	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Education	0.11285 (0.01034)	0.0001	0.11323 (0.01039)	0.0001	0.11244 (0.03228)	0.0005
Experience	0.06498 (0.04947)	0.1894	0.06441 (0.04958)	0.1943	0.06498 (0.04950)	0.1896
Experience2	-0.00096 (0.00077)	0.2117	-0.00095 (0.00077)	0.2168	-0.00096 (0.00077)	0.2121
IQscore	0.00919 (0.00697)	0.1877	0.00979 (0.00700)	0.1625	0.00919 (0.00698)	0.1880
Unionmemb	-0.00128 (0.06427)	0.9841	0.00228 (0.06471)	0.9719	-0.00131 (0.06433)	0.9838
Married	0.03335 (0.05307)	0.5299	0.03388 (0.05325)	0.5247	0.03332 (0.05315)	0.5310
Parentincome	0.00136 (0.00076)	0.0759	0.00131 (0.00077)	0.0883	0.00136 (0.00077)	0.0761
Fatheredu	-0.00811 (0.00876)	0.3547	-0.00730 (0.00880)	0.4066	-0.00812 (0.00878)	0.3553
Motheredu	0.01514 (0.00993)	0.1278	0.01456 (0.00997)	0.1447	0.01515 (0.00996)	0.1287
Extraversion			-0.00127 (0.00486)	0.7943		
Agreeableness			-0.00063 (0.00587)	0.9152		
Conscientiousness			0.00574 (0.00614)	0.3497		
Neuroticism	0.00878 (0.00490)	0.0733	0.01040 (0.00539)	0.0539	0.00841 (0.02827)	0.7662
Openness			0.00442 (0.00531)	0.4047		
Eduneuroticism					0.00003 (0.00190)	0.9893
Intercept	7.24280 (0.85123)	0.0001	6.99804 (0.89738)	0.0001	7.72643 (0.96040)	0.0001
N=842, R^2:	0.9958		0.9958		0.9958	

the next chapter.

In terms of the interaction effects, only the fixed-effects estimate for women provides a statistically significant interaction coefficient between education and conscientiousness. As described above, this outcome has important implications in terms of the total effect of education on earnings.

In general, we were expecting that the personality variables would produce more significant results as a group. This did not happen. However, our findings still encourage further research, especially with regard to the effects of the conscientiousness and neuroticism variables. We will discus this in the next chapter.

As for the estimation procedures, it seems that the FGLS estimator performed better than the OLS and GLS estimators, and the GLS estimator performed slightly better than the OLS. The fixed-effects estimation procedure produced higher values of R^2s than the OLS and GLS did. This implies that our family background variables were not as effective as the procedure applied in the fixed-effects model in capturing family-related variations. The fixed-effects model may have been more effective in capturing some other background-related variations as well. In addition, the inclusion of the interaction terms did not inflate the standard error of the education coefficient in the fixed-effects model.

Appendix to Chapter V

For both men and women, below we present the level equation estimates of the fixed-effects and GLS procedures. In chapter V, instead of these estimates, we presented conventional equation estimates to make a comparison.

	Men				Women			
	Level (eq. 15)/ F. Ef.		Level (eq.15)/ GLS		Level (eq. 15)/F. Ef.		Level (eq. 15)/GLS	
Variable	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value	Coefficient	p-value
Education	0.10283	0.0001	0.07519	0.0001	0.15625	0.0001	0.11136	0.0001
	(0.01659)		(0.01146)		(0.01614)		(0.01165)	
Experience	0.04183	0.3397	0.06897	0.0175	0.15199	0.0139	0.04223	0.3137
	(0.04375)		(0.02896)		(0.06149)		(0.00063)	
Experience2	-0.00077	0.2364	-0.00102	0.0167	-0.00205	0.0244	-0.00052	0.4068
	(0.00065)		(0.00043)		(0.00091)		(0.00063)	
IQscore	0.01844	0.0661	0.00122	0.8592	0.00720	0.5390	0.01311	0.0672
	(0.01001)		(0.00686)		(0.01171)		(0.00715)	
Unionmemb	0.12823	0.1358	0.09366	0.1217	0.12281	0.6905	0.02461	0.7037
	(0.08580)		(0.06045)		(0.08630)		(0.06468)	
Married	-0.13772	0.1042	-0.09031	0.1456	-0.5797	0.4802	0.00712	0.9059
	(0.08457)		(0.06200)		(0.08204)		(0.06019)	
Conscientiones	0.00672	0.3902	0.01089	0.0529	0.01379	0.0886		
	(0.00781)		(0.00562)		(0.00808)			
Neurroticism					0.01152	0.1060	0.00844	0.0946
					(0.00711)		(0.00505)	
Parentincome			-0.00017	0.8412			0.00146	0.0749
			(0.00083)				(0.00082)	
Fatheredu			0.00187	0.8277			-0.00188	0.8383
			(0.00861)				(0.00921)	
Motheredu			0.00798	0.4112			0.01219	0.2318
			(0.00971)				(0.01019)	
Intercept			7.76686	0.0001			7.46844	0.0001
			(0.59415)				(0.77631)	
	N=407, R^2: 0.1424		*N=814*, R^2: 0.0735		*N=421*, R^2: 0.1990		*N=842*, R^2 : 0.1194	

CHAPTER VI

CONCLUSION

Conclusions:

In this study we examine the economic return to education with particular reference to the personality traits of individuals. Within the framework of human capital theory, we use 'earnings function' type estimation techniques to determine the economic impact of educational investment. By considering men and women separately, we apply four different econometric estimation procedures to our siblings data.

Results from the fixed-effects estimates show that men earn 10 percent more for each additional year of education. This impact is about 16 percent for women. The estimated education coefficient for men is comparable to the majority of recent findings. The estimated coefficient for women, however, is somewhat higher than most of the previous estimates. Still, it almost exactly corresponds to Ashenfelter and Krueger's (1994) result from their pooled twins study. We also share their view that most of the studies may be underestimating economic returns to education.

The OLS, GLS, and FGLS estimates indicate that the economic returns to education for men and women are around 7 and 11 percent, respectfully. The differences between the fixed effects and these three estimators are mostly due to their varying ability in capturing family and other environmental background effects. The fixed-effect procedure is apparently superior to the other procedures in controlling such variations.

For both men and women, the effects of personality variables on earnings are less important than what we expected. However, we still find that the conscientiousness and neuroticism variables have a statistically significant and direct impact on earnings. The other three personality variables, extraversion, agreeableness, and openness, do not have any statistically significant impact on earnings for both genders.

For men, the fixed-effects procedure does not give any significant estimate for personality variables. The OLS, GLS, and FGLS estimates, however, indicate that earnings increase about 1.3 percent for each additional conscientiousness score.

For women, the fixed-effects estimation results show that earnings increase about 1.4 percent for each additional conscientiousness score. Nevertheless, this finding is not confirmed by OLS, GLS, and FGLS estimators. Rather, the GLS and FGLS estimates indicate that the neuroticism variable has about a 1 percent positive impact on earnings. This is in contrast to our expectation since we anticipated that the neuroticism variable may have a negative impact on earnings. We have no reasonable explanation for this outcome.

As for the interaction effects between the personality variables and education, we find very limited evidence. In fact, the evidence is limited to only the conscientiousness variable estimated for women. In general, this indicates that education and personality variables do not interact to affect earnings. In the other words, the total magnitude of the impact of education on earnings does not increase or decrease because of the personality variables. Even though this is the overall indication, we are not totally empty-handed, however. As we have just mentioned, the estimated fixed-effect results for women show that the conscientiousness and education variables interact to affect earnings. This

estimated interaction coefficient is 0.00420. The magnitude of the coefficient itself is small. Nonetheless, since it is an interaction coefficient, it has powerful implications. For example, an interquartile range of 6 points increase in the conscientiousness score raises the economic return to education by about 3 percent. The higher the conscientiousness score, the higher the total effect is.

In referring to several research findings, in their statements Hogan and Ones relate conscientiousness to job performance as follow:

> "individuals high on Conscientiousness set goals and persist in attaining them, and consequently, perform well on the job. So, one reason why Conscientiousness predicts job performance is because Conscientious individuals plan to organize their work, spend more time on their job tasks, and persist at performance, all of which result in more job knowledge and superior supervisory ratings of job performance" (Hogan and Ones, 1997, p. 860).

We think that these attributes and the consequent job performance is reflected in the labor market as higher earnings. Our findings related to the conscientiousness variable confirm this relationship. In the other words, conscientiousness increases performance which, in turn, increases earnings.

When the interaction term is present, as we found in the fixed effects estimates for women, it means that either a higher schooling level or a higher conscientiousness score increases earnings more than they would increase earnings individually. If both of them are higher, then earnings increase even more. Thus, as we demonstrated in Chapter V, the presence of any interaction term in earnings equations can explain an important portion of the earning differentials.

Implications of the Findings:

The income variations among individuals are tremendous. However, we are still far away from explaining the whole picture. Therefore, an accurate determination of the economic impact of education is obviously a big step in explaining the unexplained.

In terms of individuals, accurate estimates of returns from investing in education will serve as a valuable decision making tool in the investment decision. They will have the chance to make better decisions about their future. Instead of under-investing or over-investing, they will make more accurate investment decisions.

Our relatively higher returns to education estimates should encourage individuals to invest. Furthermore, our estimates suggest that the economic benefit of education is even higher for women. This result should encourage women to make more investment in education.

Since we find only a weak relationship between personality variables and education-and-income, we are not in the position to make powerful suggestions with regard to most of the personality traits. Nonetheless, our estimates imply that people who have higher conscientiousness scores could earn more income than other individuals could. Furthermore, we also find that more conscientious women could derive more benefit from the same level of educational investment than the other women could. So, more investment in education would have more rewarding consequences for such women. We could not find this relationship for men.

Our estimates also have important public policy implications. Human capital theory sees education as one of the most important correction tools for income inequality. Empirical studies give direction to public policy makers. In light of these studies,

especially within the past several decades, education has been comprehensively advocated as a correction tool for income inequality and unemployment in the U.S. Our findings also suggest that policies towards making it easier to finance human capital investment would decrease income inequality as we find education to be one of the most important determinants of earnings. Through supply of funds incentives, investment and labor-force participation decisions of the targeted individuals could be altered. Obviously, such policies would mean decreasing the unemployment rate among economically disadvantaged people. These would be supply side policies in terms of human capital investment equilibrium.

On the demand side, our findings do not have strong policy implications, as we find a limited relationship between personality variables and returns to education. However, staying within this limited framework of the findings, we can only suggest that the possible relationship between economic well being and behavioral well being should be monitored more closely. In fact, if the demand side of the human capital investment does not absorb the supply side policies, the equilibrium level may not be affected well enough on behalf of the targeted individuals. In the other words, demand for investment in education can not be altered if the individual characteristics are not suitable for it. For example, if single-headed families are contributing to the development of undesirable or unproductive personal characteristics, then, the individuals growing up in such families will have less demand for investment in human capital. Thus, if possible at all, corrective policies in the demand side may need priority. Otherwise, the supply side policies per se may not be effective.

Limitations of the Inquiry:

The Wisconsin Longitudinal Study (WLS) data set used in this study has a good reputation in terms of its quality. However, the WLS data have also been criticized for the fact that the primary respondents were all high school graduates. For example, Griliches (1998, p. 521) argues that the WLS data obtained from high school graduates restricts the necessary variation in the sample and thus possibly imposes a downward bias in the estimates and produces lower R^2s. He also states that the experience variable would have highly inflated standard errors as it is related to the schooling variable. Nevertheless, he makes this claim in 1976. After this date, more comprehensive data were collected from the siblings of the original respondents. The siblings are not all high school graduates. However, the percentage of the non-high school graduates is still low (around 7 percent). Our estimates may also to some degree suffer from the highly, but not completely, truncated structure of the WLS data.

Another issue related to the WLS is its representativeness. The WLS data overwhelmingly represents white Americans. Thus, it does not contain information related to race. Even though this does not affect the accuracy of our estimates, it signals caution about the interpretation of the results. Therefore, the results should be viewed as representing only white Americans.

We also would like to recognize limitations related to our personality variables. As we described in Chapter IV, the term 'personality' has a broad meaning. Our analysis however, utilizes only the five-factor personality structure. Although they may be the best among alternative assessment structures, this set of personality variables obviously

does not reflect every aspect of human behavior. Wiggins and Trapnell further clarify our concern by stating that

> "the history of the Big Five dimensions of personality structure suggests a cumulative convergence of thought that constitutes the longest, and quite possibly the most important, chapter to date in the history of personality structure research. It is clearly not the final chapter, however, and the most important developments may still lie ahead" (Wiggins and Trapnell, 1997, p. 758).

In terms of theoretical considerations, our analysis is strictly limited to the assumptions and the manifestations of the human capital theory. The other models' implications, described in Chapter II, are assumed to be irrelevant in terms of our theoretical and empirical frameworks. For example, our model assumes that each additional years of schooling has the same effect on subsequent earnings. Thus, we did not deviate from this assumption and try to see if there is a 'sheep skin' effect with regard to returns to education. Such examples can be increased if we consider all the other models of education. However, our analysis should be evaluated within the framework of the human capital theory and the related 'earnings function' specification.

Finally, we would like to say a few things about the model specification to alleviate possible concerns. As we mentioned in Chapter IV, there is a well-established model specification tradition in estimating economic return to education. Still, we can see that some researchers use a different set of independent variables in earnings equations, especially when they care about the dependent variable, income, rather than the independent variable, schooling. However, if the purpose is to determine the economic return to education by using an earnings function, care should be given to what to include and what to exclude in the equation. Otherwise we may most probably

underestimate the impact of schooling on earnings. Psacharopoulos explains this point by stating that

> "the inclusion of the other variables (such as occupation or rural-urban residence) is not appropriate on the grounds that their inclusion gives a downwards bias to the estimated rate of return, as they restrict the mobility (occupational or geographic) by means of which the returns to education are realized" (Psacharopoulos, 1987, p. 221).

In the other words, if wages are higher in urban residence, for example, education will be the cause of this wage premium, not the individuals being residents of urban areas per se. So, since the education is the cause, a separate inclusion of an urban residence variable would result in an underestimation of the impact of schooling. Similar reasoning applies to the inclusion of occupation, firm size, etc.

Within this context, we believe that our model specification is reasonably complete and probably does not have any important restriction related to the choice of independent regressors.

Suggestions for Further Research:

Our findings show that education is the most important determinant of earnings. Personality variables, on the other hand, do not have a strong impact either on the coefficient of education or on earnings. As a group, this is the overall indication of the estimation results.

However, the conscientiousness variable provides consistently significant results for both men and women. Furthermore, in female fixed-effects estimates, it interacts with education to affect earnings. Thus, further analysis about the presence and

magnitude of such direct and indirect effects would be valuable. If further research also finds an interaction effect, this would dramatically change our evaluation of the *alpha* coefficient, the coefficient of education.

The neuroticism variable gives unexpected positive results in estimates for women. This puzzle may be solved through further research.

One technical aspect of our handling of personality variables should be emphasized here. It is unnecessary to give examples here, but we often see that researchers convert their ordinal data to interval data. "Interval data represent a higher level of measurement than ordinal data, because in addition to ranking the units, interval data reflect the difference between the units with respect to the variable being measured" (McClave and Dietrich, 1994, p. 20). For various reasons, we did not convert the ordinal measures of the personality variables into intervals. Thus, our coefficient estimates of personality variables reflect the impact of only 1 point changes in the related observed values. In this way, any estimated significant coefficient, if obtained, in fact has a powerful implication. However, one can argue that personality variables deserve intervals more than any other variable, because of their nature. Of course, constructing dummy variables, thinking that a person is, for example, either a neurotic or not a neurotic, would be too extreme. Rather, constructing intervals with respect to a certain measure -i.e., interquartile range- could facilitate capturing more of the variations. These personality variables certainly deserve such a different kind of treatment.

It is possible that educational attainment can be influenced by personality variables. For example, more conscientious people may acquire more education. This means education itself becomes a function of the conscientiousness variable: $S_{ij} = f(C_{ij})$.

In this case, this functional relationship should be incorporated into the earnings equation by utilizing a simultaneous equation model. Single-equation models would produce biased estimates. Thus, if future research reveals presence of such kinds of relationships, then the use of simultaneous-equation model specification would be an appropriate approach.

Another issue that deserves a closer look is the linearity assumption of the personality variables. If an earnings equation is linear in personality variables, then the marginal effects of these variables on earnings do not depend on the levels of these personality variables at which the marginal changes occur. So, can we say with no doubt that this is the case for personality variables? For example, can we be certain that the more conscientious the person is the more he/she earns, or could there be a limit or discrepancy for this relationship? Given the data, we tried to determine if in fact the personality variables were nonlinear. We could not find evidence of nonlinearity. However, our first-hand diagnostic attempts should not be considered conclusive. A more in-depth analysis of this matter would produce valuable information for future researchers.

We find the economic return to education to be higher for women, as compared to men. This result is in harmony with some findings, but not with others. We also observe that gender-related, separately conducted, comparative rate of return studies are somewhat scarce. Thus, as the various social and economic barriers that women have been facing fall down rather quickly, more updated comparative returns to education studies become necessary. Use of a dummy variable to control for gender effect probably does not solve the problem adequately.

Bibliography

Altonji, J. G. and Dunn, T., "The Effects of Family Characteristics on the Return to Education" *Review of Economics and Statistics*, v 78, April 1996a, pp. 692-704.

_____ "Using Siblings to Estimate the Effect of School Quality on Wages," *The Review of Economics and Statistics*, v 78, June 1996b, pp. 665-671.

Anderson, K. H.; Mitchell, J. M.; Butler, J. S., "The Effect of Deviance During Adolescence on the Choice of Jobs," *Southern Economic Journal*, v 60(2), October 1993, pp. 341-356.

Andrisani, Paul J., "Internal-External Attitudes, Personal Initiative, and The Labor Market Experience of Black and White Men," *The Journal of Human Resources*, v XII(3), August 1976, pp. 309-327.

Ashenfelter, O. and Rouse, C., "Schooling, Intelligence, and Income In America: Cracks in the Bell Curve," *National Bureau of Economic Research*, No. 6902, January 1999, pp. 1-29.

Ashenfelter, O. and Zimmerman, D. J., "Estimates of the Returns to Schooling from Sibling Data: Fathers, Sons, and Brothers," *The Review of Economics and Statistics*, v 79, February 1997, pp. 1-9.

Ashenfelter, O. and Krueger, A., "Estimates of the Economic Return to Schooling from a New Sample of Twins," *The American Economic Review*, v 84 n 5, December 1994, pp. 1158-1172.

Bai, Jun, "Estimation of Earnings Function and Its Application in Human Capital Theory," http//www.eden.rutgers.edu/~jonhbai, November 1999.

Becker, Gary, *Human Capital*, 3rd ed., The University of Chicago Press, Chicago, 1993.

Becker, G. S. and Chiswick, B. R., "Education and the Distribution of Earnings," *American Economic Review*, v 56(2), 1966, pp. 358-369.

Behrman, J.; Hrubeck, Z.; Taubman, P.; Wales, T., *Socioeconomic Success: A Study of the Effects of Genetic Endowments, Family Environment, and Schooling*, North-Holland Publishing, Amsterdam, 1980.

Bowles, S.; Gintis, H.; Osborne, M., "The Determinants of Earnings: Skills, Preferences, and Schooling," *Unpublished Paper*, University of Massachusetts, January 2000, pp.1-45.

Bowles, S. and Gintis, H., "Incentive-Enhancing Preferences," *Unpublished Paper*, University of Massachusetts, December 1998, pp.1-20.

Braatz, Margaret J., *Achievement and Attitude: the Role of Cognitive Skills and Affective Traits in the Determination of Labor Market Outcomes for Young Women*, Ph.D. Dissertation, Harvard University, UMI publishing, 1999.

Brown, Nina W., "Cognitive, Interest, and Personality Variables Predicting First-Semester GPA," *Psychological Reports*, v 74(2), April 1994, pp. 605-606.

Brownlow, S.; Gilbert, N.; Reasinger, R. D., "Motivation, Personality Preferences, and Interests In College Students," *Journal of Psychological Practice*, v 3(4), Fall1997, pp. 128-140.

Caldwell, D. F. and Burger, J. M., Personality Characteristics of Job Applicants and Success in Screening Interviews," *Personnel Psychology*, v 51(1), Spring 1998, pp. 119-136.

Chamberlian, Gary, "Are Brothers As Good As Twins?" In *Kinometrics: Determinants of Socioeconomic Success Within and Between Families*, Ed. Paul Taubman, North-Holland Publishing, Amsterdam, 1977.

Chaplin, William F., "Personality, Interactive Relations, and Applied Psychology," In *Handbook of Personality Psychology*, Ed. R. Hogan, J. Johnson, S. Briggs, Academic Press, San Diego, 1997.

Chiswick, Barry R., "Interpreting the Coefficient of Schooling in the Human Capital Earnings Function," *Policy Research Working Paper*, No. 179, June 1997, pp. 1-13.

Chiswick, B. R. and Chiswick, C. U., "Income distribution and Education," In *Economics of Education: Research and Studies*, Ed. George Psacharopoluos, Pergamon Press, New York, 1987, pp. 255-261.

Costa, Paul T., "Work and Personality: Use of the NEO-PI-R In Industrial/Organizational Psychology," *Applied Psychology: An International Review Special Issue: Work and Personality*, v 45(3), July 1996, pp. 225-241.

Darity, W. Jr. and Goldsmith, A. H., "Social Psychology, Unemployment, and Macroeconomics," *Journal of Economic Perspectives*, v 10(1), Winter 1996, pp. 121-140.

Daugherty, T. K. and Lane E. J., "A longitudinal Study of Academic and Social Predictors of College Attrition," *Social Behavior & Personality*, v 27(4), 1999, pp. 355-362.

DeFreitas, G., "Segmented Labor Markets and Education," In *International Encyclopedia of Economics of Education*, Ed. Martin Carnoy, Cambridge University Press, Cambridge, UK, 1995, pp. 39-44.

Doeringer, P. B., "Internal labor markets and education," In *International Encyclopedia of Economics of Education*, Ed. Martin Carnoy, Cambridge University Press, Cambridge, UK, 1995, pp. 28-33.

Febrero, R., Schwartz, P. S., *The Essence of Becker*, Hoover Institution Press, Stanford, 1995.

Filer, Randall K., "The Role of Personality and Tastes In Determining Occupational Structure," *Industrial and Labor Relations Review*, v 39(3), April 1986, pp. 412-424.

Fleisher, B. M. and Kniesner, T. J., *Labor Economics: Theory, Evidence, and Policy*, 2nd Ed. Prentice-Hall, Inc., New Jersey, 1980.

Graziano, W. G. and Eisenberg, N., "Agreeableness: A Dimension of Personaliy," In *Handbook of Personality Psychology*, Ed. R. Hogan, J. Johnson, S. Briggs, Academic Press, San Diego, 1997.

Griliches, Zvi, *Practicing Econometrics*, Edward Elgar Publishing Limited, Cheltenham, 1998.

Groot, W. and Hartog, J., "Screening Models and Education," In *International Encyclopedia of Economics of Education*, Ed. Martin Carnoy, Cambridge University Press, Cambridge, UK, 1995, pp. 34-38.

Hartog, Joop, "Behind the Veil of Human Capital," *OICD Observer*, No. 215, January 1999, pp. 1-5.

Hauser, Robert M.; Sewell William H.; Hauser, Taissa S.; Logan, John A.; Ryff, Carol; Caspi, Avshalom; and MacDonald, Maurice M. [principal investigators]. *Wisconsin Longitudinal Study (WLS) [siblings]: 1993/94.* University of Wisconsin-Madison, WI: Data and Program Library Service: [distributor]; [machine-readable data file] / <http://dpls.dacc.wisc.edu/WLSSB6331.htm>

Hauser, Robert M.; Carr, Deborah; Hauser, Taissa S.; Krecker, Margaret; Kuo, Daphne; Presti, John et al., "The Class of 1957 after 35 Years: Overview and Preliminary Findings," *CDE Working Paper,* v 17, Center for Demography and Ecology, University of Wisconsin-Madison, 1993.

Hauser, Robert M.; Sewell William H., *Education, Occupation, and Earnings,* Academic Press, Inc., New York, 1975.

Haveman, R. and Wolfe, B., "The Determinants of Children's Attainments: A Review of Methods and Findings," *Journal of Economic Literature*, v 33(4), December 1995, pp. 1829-78.

Hill, O. W. and Huntley, L., "Internal-External Dimension of Epistemic and Personality Factors and A Measure of Achievement Motivation," *Psychological Reports*, v 82(3, Pt 2), June 1998, pp. 1331-1334.

Hinchliffe, K., "Education and the Labor Market," In *International Encyclopedia of Economics of Education*, Ed. Martin Carnoy, Cambridge University Press, Cambridge, UK, 1995, pp. 20-23.

Hogan, J. and Ones, D. S., "Conscientiousness and Integrity at Work," In *Handbook of Personality Psychology*, Ed. R. Hogan, J. Johnson, S. Briggs, Academic Press, San Diego, 1997.

Hughes, R. L.; Ginnett, R. C.; Curphy, G. J., *Leadership: Enhancing the Lessons of Experience*, Richard D. Irwin, Inc., Illinois, 1993.

Jencks, C.; Bartlett, S.; Corcoran, M. et al., *Who Gets Ahead? : Determinants of Economic Success in America*, Basic Books, Inc., New York, 1979.

Johnes, Geraint, *The Economics of Education*, St. Martin's Press, New York, 1993.

Johnston, J. and Dinardo, J., *Econometric Methods*, 4th ed., The McGraw-Hill Companies, Inc., New York, 1997.

Judge, G. G.; Hill, R. C.; Griffiths, W. E.; Lee, T. C., *Introduction to the Theory and Practice of Econometrics*, 2nd ed., John Wiley, New York, 1988.

Kane T. J. and Rouse, C. E., "Labor-Market Returns to Two-and Four Year College" *The American Economic Review*, v 85, n 3, 1995, pp. 600-614.

Kennedy, Peter, *A Guide to Econometrics*, 3rd ed., The MIT Press, Cambridge, 1996.

Krueger, A. B. and Lindahl, M., "Education for Growth: Why and for Whom?" *NBER Working Paper Series*, No. 7591, March 2000, pp. 1-50.

Levin, H. M., "Work and Education," In *Economics of Education: Research and Studies*, Ed. George Psacharopoluos, Pergamon Press, New York, 1987, pp. 146-157.

Mankiw, Gregory N., *Principles of Economics*, Dryden Press, Forth Worth, 1998.

Marshall, F. R. and Briggs, V. M., *Labor Economics: Theory, Institutions, and Public Policy*, 6th Ed., Irwin Publications, Illinois, 1989.

McClave, J. T. and Dietrich II, F. H., *Statistics*, 6th ed., Macmillan College Publishing Company, New York, 1994.

McCrae, R. R. and Costa, P. T., "Conceptions and Correlates of Openness to Experience," In *Handbook of Personality Psychology*, Ed. R. Hogan, J. Johnson, S. Briggs, Academic Press, San Diego, 1997.

McNab, R., "Labor Market Theories and Education," In *Economics of Education: Research and Studies*, Ed. George Psacharopoluos, Pergamon Press, New York, 1987, pp. 157-163.

Mincer, Jacob, *Schooling, Experience, and Earnings*, National Bureau of Economic Research, New York, 1974.

Miller, P; Mulvey, C.; Martin, N., "Family Characteristics and The Returns to Schooling: Evidence on Gender Differences from a Sample of Australian Twins," *Economica,* v 64, 1997, pp. 119-136.

_____ "What do Twin Studies Reveal About the Economic Returns to Education? A Comparison of Australian and U.S. Findings," *The American Economic Review*, v 85 n. 3, June 1995, pp. 586-599.

Motowidlo, S. J.; Borman, W. C.; Schmit, M. J., "A Theory of Individual Differences In Task and Contextual Performance," *Human Performance*, v 10(2), 1997, pp. 71-83.

Peterson, J. B. and Carson, S., "Latent Inhibition and Openness to Experience In A High-achieving Student Population," *Personality & Individual Differences*, v 28(2), February 2000, pp. 323-332.

Psacharopoulos, George, "Earnings Functions," In *Economics of Education: Research and Studies*, Ed. George Psacharopoluos, Pergamon Press, New York, 1987, p. 221.

_____ "Returns to Education: an Updated International Comparison," *Comparative Education*, v 17(3), 1981, pp. 321-341.

Rouse, Cecilia A., "Further Estimates of the Economic Return to Schooling from a New Sample of Twins," *Economics of Education Review*, v 18, 1999, pp. 149-157.

Rowe, David C., "Genetics, Temperament, and Personality" In *Handbook of Personality Psychology*, Ed. R. Hogan, J. Johnson, S. Briggs, Academic Press, San Diego, 1997.

Stewart, Greg L., "Trait Bandwidth and Stages of Job Performance: Assessing Differential Effects For Conscientiousness and Its Subtraits," *Journal of Applied Psychology,* v 84(4), December 1999, pp. 959-968.

Viesca, Jamie R. de la, "Linking Human Capital and Economic Growth," http://www.jrc.es/pages /iptsreport/vol37/english/EHC3E376.htm.

Watson, D. and Clark, L. A., "Extraversion and Its Positive Emotional Core," In *Handbook of Personality Psychology*, Ed. R. Hogan, J. Johnson, S. Briggs, Academic Press, San Diego, 1997.

Wiggins, J. S. and Trapnell, P. D., "Personality Structure: The Return of the Big Five," In *Handbook of Personality Psychology*, Ed. R. Hogan, J. Johnson, S. Briggs, Academic Press, San Diego, 1997.

William G. G. and Eisenberg, N., "Agreeableness: A Dimension of Personality," In *Handbook of Personality Psychology*, Ed. R. Hogan, J. Johnson, S. Briggs, Academic Press, San Diego, 1997.

Winkler, D. R., "Screening Models and Education," In *International Encyclopedia of Economics of Education*, Ed. Martin Carnoy, Cambridge University Press, Cambridge, UK, 1995, pp. 287-291.

Woodhall, M., "Human Capital Concepts," In *International Encyclopedia of Economics of Education*, Ed. Martin Carnoy, Cambridge University Press, Cambridge, UK, 1995, pp. 24-28.

_____ "Earnings and Education," In *International Encyclopedia of Economics of Education*, Ed. Martin Carnoy, Cambridge University Press, Cambridge, UK, 1995, pp. 209-217.

_____ "Human Capital Concepts," In *Economics of Education: Research and Studies*, Ed. George Psacharopoluos, Pergamon Press, New York, 1987, pp. 21-23.

Wright, P. M.; Kacmar, K. M.; McMahan, G. C., "P = (M X A): Cognitive Ability As A Moderator of the Relationship Between Personality and Job Performance," *Journal of Management,* v 21(6), 1995, pp. 1129-1139.

APPENDIXES:

Below we provide two appendixes. In Appendix A simple statistics and the correlation matrix for the male data are given. In Appendix B the same information is presented for the female data.

APPENDIX A:

i)- Simple Statistics for Variables Used in the Fixed-Effects Procedure -- n=407.

Variable*	Mean	Std Dev	Minimum	Maximum
Lnincome	0.05665	1.01112	-2.99573	2.59984
education	-0.47420	3.09516	-8.00000	9.00000
experience	0.91155	7.80659	-22.00000	20.00000
experience2	7.63391	526.16684	-1804	1007
IQscore	-3.05651	4.69926	-14.00000	11.00000
unionmemb	0.05897	0.54948	-1.00000	1.00000
married	0.01966	0.55674	-1.00000	1.00000
extraversion	-0.10811	7.31407	-23.00000	18.00000
agreeableness	-0.43489	6.07953	-17.00000	15.00000
conscientiousness	0.49877	6.02902	-20.00000	19.00000
neuroticism	-0.09828	6.71115	-18.00000	16.00000
openness	-0.07617	5.50518	-11.00000	12.00000

*All variables are described in Chapter IV.

ii)- Simple Statistics for Variables Used in Cross-Sectional Units(OLS, GLS, and FGLS)--n=814.

Variable*	Mean	Std Dev	Minimum	Maximum
lnincome	10.2875345	0.7119168	8.389	12.612
education	13.7063882	2.3429323	8.000	20.000
experience	33.3550369	5.6416561	15.000	53.000
experience2	1144.35	378.2499558	225.000	2809.000
IQscore	9.3882064	3.5943318	0	19.000
unionmemb	0.2014742	0.4013480	0	1.000
married	0.8083538	0.3938381	0	1.000
parentincome	62.0319410	31.9572510	3.000	150.000
fatheredu	9.9140049	3.4434422	2.000	21.000
motheredu	10.4594595	2.9439542	0	18.000
extraversion	22.4815725	5.4107114	3.000	36.000
agreeableness	27.7899263	4.4250041	11.000	36.000
conscientiousness	28.6326781	4.3326006	13.000	36.000
neuroticism	15.7272727	4.6819449	5.000	30.000
openness	21.6031941	4.3560524	10.000	35.000
eduextraversion	308.5331695	93.9859624	39.000	680.000
eduagreeableness	381.1031941	89.8668232	132.000	660.000
educonscientiousness	392.7248157	91.2453430	156.000	680.000
eduneuroticism	215.4090909	74.3759835	60.000	504.000
eduopenness	296.3415233	80.1165591	117.000	660.000

*All variables are described in Chapter IV.

iii)- Simple Statistics for each sibling--n=407X2.

Variable*	Mean	Std Dev	Minimum	Maximum
lnincom	10.31586	0.73314	8.41183	12.61154
lnincomes	10.25921	0.68978	8.38936	12.42922
educatio	13.46929	2.18558	12.00000	20.00000
educations	13.94349	2.47037	8.00000	20.00000
age	53.28010	0.59981	52.00000	55.00000
ages	52.84275	7.21280	37.00000	72.00000
IQ	7.85995	2.68228	1.00000	14.00000
IQs	10.91646	3.74072	0	19.00000
marriageo	0.81818	0.38617	0	1.00000
marriagess	0.79853	0.40160	0	1.00000
unionmemo	0.23096	0.42196	0	1.00000
unionmemss	0.17199	0.37784	0	1.00000
exage	33.81081	2.23741	27.00000	37.00000
exsage	32.89926	7.63626	15.00000	53.00000
exage2	1148	146.18741	729.00000	1369
exsage2	1141	514.87716	225.00000	2809
extraversio	22.42752	5.41518	3.00000	36.00000
extraversiosib	22.53563	5.41236	9.00000	36.00000
agreeablenes	27.57248	4.44828	11.00000	36.00000
agreeablenessib	28.00737	4.39631	15.00000	36.00000
conscientiousnes	28.88206	4.25028	13.00000	36.00000
conscientiousnessib	28.38329	4.40449	16.00000	36.00000
neuroticis	15.67813	4.71473	5.00000	29.00000
neuroticissib	15.77641	4.65421	5.00000	30.00000
opennes	21.56511	4.35099	11.00000	34.00000
opennessib	21.64128	4.36613	10.00000	35.00000
parincome	62.03194	31.95725	3.00000	150.00000
fatheredu	9.91400	3.44556	2.00000	21.00000
motheredu	10.45946	2.94577	0	18.00000

*These are variable names for *each* sibling. We call the original high school respondents *primary* respondents, and their siblings as *sibling* respondents in distinguishing each siblings. *p* and *s* denote primary and sibling respondents, respectively: lnincom (log income, p), lnincomes (log income, s), educatio (education, p), educations (education, s), age (age, p), ages (age, s), IQ (IQ, p), Iqs (IQ, s), marriageo (marriage st., p), marriagess (marriage st., s), unionmemo (union memb., p), unionmemss (union mem., s), exage (experience, p), exsage (experience, s), exage2 (exp. squared, p), exsage2 (exp. squared, s), extraversio (extraversion, p), extraversiosib (etraversion, s), agreeablenes (agreeableness, p), agreeablenessib (agreeableness, s), conscientiousnes (conscientiousness, p), conscientiousnessib (conscientiousness, s), neuroticis (neuroticism, p), neuroticissib (neuroticism, s), opennes (openness, p), opennessib (openness, s), parincome (parent inc., p, s), fatheredu (father's education, p, s), motheredu (mother's education, p, s). The correlation matrix below also uses these variable names.

Correlation matrix for male siblings

Pearson Correlation Coefficients, N = 407
Prob > |r| under H0: Rho=0

	lnincom	lnincomes	educatio	educations	age	ages	IQ
lnincom	1.00000						
lnincomes	-0.00897 0.8568	1.00000					
educatio	0.26319 <.0001	-0.02917 0.5573	1.00000				
educations	-0.12333 0.0128	0.21697 <.0001	0.12034 0.0151	1.00000			
age	0.02844 0.5673	0.05978 0.2288	0.04979 0.3163	0.03066 0.5374	1.00000		
ages	0.09404 0.0580	0.00339 0.9456	-0.01218 0.8064	-0.00520 0.9167	0.09048 0.0682	1.00000	
IQ	0.01091 0.8263	-0.07946 0.1095	-0.00725 0.8841	-0.00789 0.8739	-0.01995 0.6881	0.00204 0.9672	1.00000
IQs	-0.06759 0.1735	0.03164 0.5245	0.01264 0.7993	-0.00078 0.9875	0.01265 0.7992	-0.06612 0.1831	-0.04462 0.3693
marriageo	-0.04625 0.3520	-0.03974 0.4239	0.03131 0.5288	0.04600 0.3546	-0.00290 0.9535	-0.00056 0.9910	-0.02702 0.5867
marriagess	0.08602 0.0831	-0.06354 0.2008	0.02941 0.5541	-0.01647 0.7404	-0.01055 0.8319	-0.06964 0.1608	-0.04912 0.3229
unionmemo	0.06030 0.2248	-0.02866 0.5642	-0.02968 0.5505	0.00783 0.8749	-0.04213 0.3966	0.03058 0.5385	0.05911 0.2341
unionmemss	0.01566 0.7527	0.02007 0.6864	0.05115 0.3033	-0.04762 0.3380	-0.11528 0.0200	0.00091 0.9854	0.03598 0.4692
exage	-0.24947 <.0001	0.04453 0.3703	-0.96349 <.0001	-0.10933 0.0274	0.21945 <.0001	0.03616 0.4670	0.00173 0.9722
exsage	0.12873 0.0093	-0.06699 0.1774	-0.05044 0.3101	-0.32842 <.0001	0.07554 0.1281	0.94623 <.0001	0.00448 0.9282

	IQs	marriageo	marriagess	unionmemo	unionmemss	exage	exsage
IQs	1.00000						
marriageo	-0.05487 0.2694	1.00000					
marriagess	-0.04894 0.3247	0.00144 0.9768	1.00000				
unionmemo	-0.05172 0.2979	0.03160 0.5249	-0.08810 0.0758	1.00000			
unionmemss	0.01542 0.7565	0.04604 0.3542	0.00168 0.9731	0.05921 0.2333	1.00000		
exage	-0.00896 0.8571	-0.03136 0.5282	-0.03156 0.5255	0.01770 0.7219	-0.08087 0.1033	1.00000	
exsage	-0.06221 0.2105	-0.01541 0.7565	-0.06045 0.2237	0.02635 0.5961	0.01626 0.7436	0.06952 0.1615	1.00000

	lnincom	lnincomes	educatio	educations	age	ages	IQ
exage2	-0.24617	0.04783	-0.95963	-0.10755	0.23155	0.03636	-0.00122
	<.0001	0.3358	<.0001	0.0301	<.0001	0.4645	0.9805
exsage2	0.12535	-0.07755	-0.04638	-0.31445	0.07055	0.94032	0.00514
	0.0114	0.1183	0.3507	<.0001	0.1554	<.0001	0.9177
extraversio	-0.03672	0.05756	0.09331	0.11449	-0.00814	-0.10932	0.08180
	0.4601	0.2466	0.0600	0.0209	0.8699	0.0274	0.0994
extraversiosib	-0.10470	0.02040	-0.07877	-0.02573	0.02499	-0.03311	0.01027
	0.0347	0.6815	0.1126	0.6047	0.6152	0.5054	0.8364
agreeablenes	-0.01049	0.02457	0.11493	0.05473	-0.00670	-0.06390	-0.01040
	0.8329	0.6211	0.0204	0.2707	0.8927	0.1983	0.8343
agreeablenessib	-0.00450	0.07553	-0.09085	-0.07480	-0.02881	-0.03942	0.05084
	0.9278	0.1282	0.0671	0.1319	0.5623	0.4277	0.3062
conscientiousnes	0.06687	0.05746	0.06139	0.03924	-0.10585	0.00775	0.02858
	0.1781	0.2475	0.2165	0.4298	0.0328	0.8761	0.5654
conscientiousnessib	-0.02987	0.07969	-0.08935	0.00901	0.02266	0.02539	0.06418
	0.5479	0.1084	0.0718	0.8562	0.6485	0.6095	0.1963
neuroticis	0.04395	-0.02967	-0.03502	-0.00474	0.02847	-0.01562	0.02623
	0.3765	0.5507	0.4811	0.9241	0.5668	0.7535	0.5978
neuroticissib	0.01363	-0.00601	0.11034	0.00233	-0.10103	-0.11734	0.05608
	0.7840	0.9037	0.0260	0.9627	0.0416	0.0179	0.2590
opennes	0.00755	-0.05706	0.01582	-0.01627	0.00715	0.02160	-0.08015
	0.8792	0.2507	0.7504	0.7435	0.8856	0.6640	0.1064
opennessib	-0.00376	-0.01150	-0.06388	0.02894	0.11558	-0.00829	-0.12208
	0.9397	0.8171	0.1984	0.5604	0.0197	0.8676	0.0137
parincome	0.02594	-0.03598	0.09283	0.04355	-0.00701	0.00440	0.05002
	0.6018	0.4691	0.0613	0.3808	0.8880	0.9295	0.3141
fatheredu	0.04963	0.00039	-0.01131	-0.00347	0.02003	0.08380	-0.04661
	0.3179	0.9937	0.8201	0.9444	0.6871	0.0914	0.3482

	IQs	marriageo	marriagess	unionmemo	unionmemss	exage	exsage
exage2	-0.00725	-0.03363	-0.03233	0.01579	-0.08136	0.99948	0.06914
	0.8840	0.4987	0.5155	0.7508	0.1012	<.0001	0.1639
exsage2	-0.06606	-0.01015	-0.06101	0.02883	0.01176	0.06422	0.98990
	0.1835	0.8382	0.2194	0.5619	0.8130	0.1960	<.0001
extraversio	0.02487	-0.00867	0.00573	-0.05841	0.01574	-0.09333	-0.14030
	0.6169	0.8615	0.9083	0.2397	0.7516	0.0600	0.0046
extraversiosib	0.07691	-0.07585	0.03617	-0.06293	0.05240	0.08365	-0.02295
	0.1213	0.1266	0.4668	0.2052	0.2916	0.0919	0.6444
agreeablenes	0.03278	-0.03963	0.00957	-0.02469	-0.03821	-0.11407	-0.07806
	0.5096	0.4253	0.8473	0.6195	0.4420	0.0214	0.1159
agreeablenessib	0.06519	0.01240	-0.04101	0.01103	-0.06156	0.08102	-0.01304
	0.1894	0.8031	0.4093	0.8244	0.2152	0.1026	0.7932
conscientiousnes	-0.04276	-0.14665	-0.06157	0.00286	-0.01034	-0.08834	-0.00538
	0.3896	0.0030	0.2151	0.9541	0.8352	0.0750	0.9139
conscientiousnessib	-0.01465	-0.00961	-0.03700	-0.05570	-0.04711	0.09336	0.02107
	0.7683	0.8467	0.4567	0.2622	0.3431	0.0599	0.6717
neuroticis	-0.04398	0.02189	-0.00702	0.03251	-0.08361	0.04185	-0.01322
	0.3761	0.6597	0.8878	0.5132	0.0921	0.3998	0.7904
neuroticissib	-0.03913	0.04722	-0.00439	-0.00374	0.07515	-0.13487	-0.11159
	0.4311	0.3420	0.9296	0.9400	0.1302	0.0064	0.0244
opennes	0.00064	-0.05451	-0.04181	-0.07797	0.00516	-0.01353	0.02566
	0.9898	0.2726	0.4002	0.1163	0.9174	0.7855	0.6057
opennessib	0.05155	-0.08552	-0.03570	-0.11802	-0.03865	0.09339	-0.01719
	0.2995	0.0848	0.4726	0.0172	0.4367	0.0598	0.7295
parincome	-0.06340	0.12095	0.03569	-0.02088	0.11273	-0.09256	-0.00994
	0.2018	0.0146	0.4728	0.6744	0.0229	0.0621	0.8416
fatheredu	0.02696	0.04746	0.00881	0.01539	0.00950	0.01642	0.08027
	0.5876	0.3396	0.8594	0.7569	0.8485	0.7413	0.1059

	exage2	exsage2	extraversio	extraversiosib	agreeablenes
exage2	1.00000				
exsage2	0.06389 0.1983	1.00000			
extraversio	-0.09191 0.0640	-0.13310 0.0072	1.00000		
extraversiosib	0.08406 0.0903	-0.02793 0.5743	0.08738 0.0783	1.00000	
agreeablenes	-0.11454 0.0208	-0.07686 0.1216	0.13818 0.0052	0.06642 0.1811	1.00000
agreeablenessib	0.08090 0.1032	-0.00116 0.9814	0.04798 0.3343	0.10956 0.0271	0.05508 0.2676
conscientiousnes	-0.08912 0.0725	-0.00622 0.9005	0.26684 <.0001	0.07856 0.1136	0.27898 <.0001
conscientiousnessib	0.09267 0.0618	0.03062 0.5379	0.05301 0.2860	0.22684 <.0001	-0.00431 0.9309
neuroticis	0.04192 0.3990	-0.01178 0.8127	-0.14066 0.0045	0.01420 0.7751	-0.30970 <.0001
neuroticissib	-0.13580 0.0061	-0.10782 0.0296	0.03664 0.4610	-0.10367 0.0366	0.00370 0.9407
opennes	-0.01108 0.8237	0.02174 0.6619	0.19974 <.0001	0.03920 0.4303	0.05604 0.2594
opennessib	0.09445 0.0569	-0.01635 0.7423	0.02515 0.6129	0.20796 <.0001	0.01998 0.6877
parincome	-0.09349 0.0595	-0.01275 0.7976	0.13090 0.0082	-0.03345 0.5010	0.02575 0.6044
fatheredu	0.01647 0.7405	0.07282 0.1425	0.01108 0.8236	0.06429 0.1956	-0.01735 0.7271

	agreeablenessib	conscientiousnes	conscientiousnessib	neuroticis
agreeablenessib	1.00000			
conscientiousnes	0.02048 0.6804	1.00000		
conscientiousnessib	0.36505 <.0001	0.02979 0.5490	1.00000	
neuroticis	0.00998 0.8409	-0.31189 <.0001	0.05767 0.2457	1.00000
neuroticissib	-0.31506 <.0001	-0.00582 0.9068	-0.17267 0.0005	-0.02619 0.5984
opennes	0.04086 0.4110	0.09991 0.0440	0.03571 0.4725	-0.19631 <.0001
opennessib	0.04133 0.4057	-0.00189 0.9697	0.12641 0.0107	-0.05265 0.2893
parincome	0.00701 0.8879	-0.01199 0.8095	0.04901 0.3240	0.02550 0.6080
fatheredu	0.02801 0.5731	0.03883 0.4347	0.02896 0.5602	-0.07039 0.1563

	neuroticissib	opennes	opennessib	parincome	fatheredu	motheredu
neuroticissib	1.00000					
opennes	-0.02890 0.5610	1.00000				
opennessib	-0.18165 0.0002	0.20233 <.0001	1.00000			
parincome	-0.00809 0.8708	-0.04719 0.3423	-0.03558 0.4740	1.00000		
fatheredu	-0.05941 0.2317	-0.05655 0.2550	-0.00893 0.8574	-0.06147 0.2159	1.00000	

	lnincom	lnincomes	educatio	educations	age	ages	IQ
motheredu	0.02036	0.05441	-0.04696	-0.02113	0.03990	-0.04447	-0.02737
	0.6821	0.2734	0.3446	0.6708	0.4221	0.3709	0.5819

	IQs	marriageo	marriagess	unionmemo	unionmemss	exage	exsage
motheredu	0.08240	-0.02598	-0.05481	0.06502	-0.05347	0.05657	-0.03517
	0.0969	0.6012	0.2700	0.1905	0.2819	0.2548	0.4793

	exage2	exsage2	extraversio	extraversiosib	agreeablenes
motheredu	0.05868	-0.05214	-0.02346	0.07521	-0.07106
	0.2375	0.2940	0.6370	0.1298	0.1524

	agreeablenessib	conscientiousnes	conscientiousnessib	neuroticis
motheredu	0.01286	0.04585	-0.02538	-0.05086
	0.7959	0.3562	0.6097	0.3060

	neuroticissib	opennes	opennessib	parincome	fatheredu	motheredu
motheredu	-0.03201	0.02312	-0.01147	-0.09152	0.50866	1.00000
	0.5196	0.6419	0.8175	0.0651	<.0001	

APPENDIX B:

In Appendix B simple statistics and the correlation matrix for the female data are presented.

i)- Simple Statistics for Variables Used in the Fixed-Effects Procedure -- n=421.

Variable*	Mean	Std Dev	Minimum	Maximum
lnincome	-0.05776	1.02107	-2.81341	2.81341
education	-0.10689	3.00166	-8.00000	9.00000
experience	0.38955	6.42208	-15.00000	15.00000
experience2	-8.69834	431.55929	-1275.00000	793.00000
IQscore	-3.38005	3.88562	-12.00000	7.00000
unionmemb	-0.00238	0.52326	-1.00000	1.00000
married	0.01188	0.55836	-1.00000	1.00000
extraversion	0.36105	7.28291	-18.00000	19.00000
agreeableness	0.88124	6.03246	-16.00000	16.00000
conscientiousness	0.66746	5.70869	-15.00000	14.00000
neuroticism	0.76247	6.48556	-15.00000	17.00000
openness	0.23515	6.58926	-20.00000	19.00000

*All variables are described in Chapter IV.

ii)- Simple Statistics for Variables Used in Cross-Sectional Units(OLS, GLS, and FGLS)--n=842.

Variable*	Mean	Std Dev	Minimum	Maximum
lnincome	10.2688742	0.7355416	8.377	12.707
education	13.5427553	2.2755906	7.000	21.000
experience	33.6508314	4.7762473	16.000	50.000
experience2	1155.16	320.2672550	256.000	2500.000
IQscore	9.4334917	3.4363199	0	19.000
unionmemb	0.1650831	0.3714762	0	1.000
married	0.7992874	0.4007715	0	1.000
parentincome	61.1330166	35.3752283	4.000	150.000
fatheredu	10.1876485	3.6140089	0	24.000
motheredu	10.7102138	3.0550425	3.000	21.000
extraversion	22.7933492	5.2370720	6.000	36.000
agreeableness	28.6211401	4.2204620	15.000	36.000
conscientiousness	28.8277910	4.2032248	16.000	36.000
neuroticism	16.0938242	4.7941686	5.000	30.000
openness	21.7589074	4.8160031	8.000	36.000
eduextraversion	309.6140143	92.5596093	72.000	680.000
eduagreeableness	387.8004751	88.3193891	180.000	720.000
educonscientiousness	390.1983	86.2812774	176.000	720.000
eduneuroticism	217.4133017	73.4655490	60.000	510.000
eduopenness	294.7755344	82.4218477	96.000	627.000

*All variables are described in Chapter IV.

iii)- Simple Statistics for each sibling--n=421X2.

Variable*	Mean	Std Dev	Minimum	Maximum
lnincom	10.23999	0.74711	8.37655	12.67608
lnincomes	10.29775	0.72352	8.47637	12.70685
educatio	13.48931	2.19805	12.00000	21.00000
educations	13.59620	2.35198	7.00000	20.00000
age	53.33492	0.59317	52.00000	55.00000
ages	53.05226	6.08762	40.00000	68.00000
IQ	7.74347	2.55990	0	14.00000
IQs	11.12352	3.37130	1.00000	19.00000
marriageo	0.80523	0.39650	0	1.00000
marriagess	0.79335	0.40538	0	1.00000
unionmemo	0.16390	0.37062	0	1.00000
unionmemss	0.16627	0.37277	0	1.00000
exage	33.84561	2.30267	26.00000	37.00000
exsage	33.45606	6.34831	16.00000	50.00000
exage2	1151	149.52249	676.00000	1369.00000
exsage2	1160	427.77512	256.00000	2500.00000
extraversio	22.97387	5.15999	6.00000	36.00000
extraversiosib	22.61283	5.31303	9.00000	36.00000
agreeablenes	29.06176	3.98222	16.00000	36.00000
agreeablenessib	28.18052	4.40678	15.00000	36.00000
conscientiousnes	29.16152	3.94878	16.00000	36.00000
conscientiousnessib	28.4941	4.42268	16.00000	36.00000
neuroticis	16.47506	4.95960	6.00000	30.00000
neuroticissib	15.71259	4.59716	5.00000	29.00000
opennes	21.87648	5.00466	8.00000	36.00000
opennessib	21.64133	4.62263	9.00000	36.00000
parincome	61.13302	35.37528	4.00000	150.00000
fatheredu	10.18765	3.61616	0	24.00000
motheredu	10.71021	3.05686	3.00000	21.00000

*These are variable names for *each* sibling. We call the original high school respondents *primary* respondents, and their siblings as *sibling* respondents in distinguishing each sibling. *p* and *s* denote primary and sibling respondents, respectively: lnincom (log income, p), lnincomes (log income, s), educatio (education, p), educations (education, s), age (age, p), ages (age, s), IQ (IQ, p), Iqs (IQ, s), marriageo (marriage st., p), marriagess (marriage st., s), unionmemo (union memb., p), unionmemss (union mem., s), exage (experience, p), exsage (experience, s), exage2 (exp. squared, p), exsage2 (exp. squared, s), extraversio (extraversion, p), extraversiosib (etraversion, s), agreeablenes (agreeableness, p), agreeablenessib (agreeableness, s), conscientiousnes (conscientiousness, p), conscientiousnessib (conscientiousness, s), neuroticis (neuroticism, p), neuroticissib (neuroticism, s), opennes (openness, p), opennessib (openness, s), parincome (parent inc., p, s), fatheredu (father's education, p, s), motheredu (mother's education, p, s). The correlation matrix below also uses these variable names.

Correlation matrix for female siblings

Pearson Correlation Coefficients, N = 421
Prob > |r| under H0: Rho=0

	lnincom	lnincomes	educatio	educations	age	ages	IQ
lnincom	1.00000						
lnincomes	0.03615 0.4595	1.00000					
educatio	0.43249 <.0001	-0.04054 0.4067	1.00000				
educations	-0.08900 0.0681	0.19872 <.0001	0.13088 0.0072	1.00000			
age	0.00310 0.9494	0.04318 0.3768	-0.04564 0.3502	-0.05813 0.2339	1.00000		
ages	-0.11155 0.0221	0.08815 0.0708	-0.10939 0.0248	0.07997 0.1013	-0.01145 0.8148	1.00000	
IQ	0.02037 0.6768	0.05192 0.2879	0.03633 0.4573	-0.05363 0.2723	0.05201 0.2870	-0.01778 0.7161	1.00000
IQs	-0.03283 0.5017	0.05679 0.2449	0.01175 0.8101	-0.04504 0.3566	0.03761 0.4416	0.01511 0.7572	0.16342 0.0008
marriageo	0.02394 0.6243	-0.04565 0.3501	0.00580 0.9055	0.00227 0.9630	-0.00543 0.9115	0.03678 0.4517	-0.05873 0.2292
marriagess	-0.01210 0.8045	-0.01346 0.7830	0.00954 0.8453	0.02714 0.5786	-0.00854 0.8613	-0.03228 0.5090	0.00156 0.9745
unionmemo	-0.00073 0.9881	-0.04047 0.4075	0.05915 0.2259	-0.06047 0.2157	-0.02284 0.6402	0.03841 0.4319	0.00427 0.9304
unionmemss	0.03958 0.4179	0.05742 0.2397	0.06610 0.1758	0.01973 0.6864	-0.01555 0.7504	0.00980 0.8411	-0.02007 0.6814
exage	-0.41204 <.0001	0.04982 0.3078	-0.96632 <.0001	-0.13991 0.0040	0.30117 <.0001	0.10147 0.0374	-0.02128 0.6633
exsage	-0.07399 0.1296	0.01091 0.8234	-0.15339 0.0016	-0.29381 <.0001	0.01056 0.8290	0.92931 <.0001	0.00282 0.9540

	IQs	marriageo	marriagess	unionmemo	unionmemss	exage	exsage
IQs	1.00000						
marriageo	-0.14583 0.0027	1.00000					
marriagess	0.10409 0.0328	0.03044 0.5334	1.00000				
unionmemo	-0.06960 0.1540	0.07193 0.1406	0.00410 0.9331	1.00000			
unionmemss	-0.01828 0.7085	0.05854 0.2307	-0.03993 0.4138	0.00909 0.8525	1.00000		
exage	-0.00152 0.9751	-0.00694 0.8871	-0.01131 0.8171	-0.06235 0.2017	-0.06711 0.1693	1.00000	
exsage	0.03118 0.5234	0.03443 0.4811	-0.04101 0.4013	0.05923 0.2252	0.00209 0.9659	0.14914 0.0022	1.00000

	lnincom	lnincomes	educatio	educations	age	ages	IQ
exage2	-0.41010	0.05248	-0.96270	-0.14269	0.31162	0.09861	-0.02241
	<.0001	0.2827	<.0001	0.0033	<.0001	0.0431	0.6466
exsage2	-0.06716	0.00826	-0.15623	-0.28113	0.00718	0.92711	0.00500
	0.1690	0.8659	0.0013	<.0001	0.8833	<.0001	0.9186
extraversio	-0.00034	0.05279	0.01813	0.04464	-0.01036	-0.02838	0.03590
	0.9945	0.2798	0.7106	0.3609	0.8322	0.5614	0.4625
extraversiosib	0.03913	0.02383	0.03339	0.13417	0.04578	-0.00828	-0.02745
	0.4233	0.6259	0.4945	0.0058	0.3488	0.8655	0.5743
agreeablenes	-0.03607	-0.08157	0.05774	-0.02148	-0.09143	-0.11711	-0.01619
	0.4604	0.0946	0.2371	0.6603	0.0609	0.0162	0.7404
agreeablenessib	-0.01360	0.00580	0.01470	-0.00719	-0.02774	0.03408	0.03155
	0.7809	0.9055	0.7636	0.8830	0.5703	0.4855	0.5185
conscientiousnes	0.05868	-0.01713	0.07865	0.03268	-0.06381	-0.02937	0.03897
	0.2295	0.7261	0.1071	0.5037	0.1913	0.5478	0.4252
conscientiousnessib	-.1193	-.06132	-0.12755	-0.10255	0.12374	0.02654	0.00512
	0.0143	0.2092	0.0088	0.0354	0.0111	0.5871	0.9165
neuroticis	0.01811	0.03157	-0.09061	-0.05720	0.01863	0.02954	0.01975
	0.7109	0.5183	0.0632	0.2415	0.7031	0.5456	0.6862
neuroticissib	-0.03685	0.06750	0.01489	-0.00525	-0.01875	-0.00840	-0.07608
	0.4508	0.1669	0.7606	0.9144	0.7013	0.8636	0.1191
opennes	0.00456	-0.01549	0.01070	0.06230	0.00595	0.00287	-0.06065
	0.9257	0.7514	0.8267	0.2020	0.9032	0.9532	0.2143
opennessib	0.01224	-0.02550	0.03208	0.00877	0.01092	0.01454	-0.02651
	0.8022	0.6019	0.5116	0.8577	0.8233	0.7661	0.5876
parincome	-0.08728	-0.06421	-0.05019	0.02233	0.00216	0.05984	0.03589
	0.0736	0.1886	0.3042	0.6478	0.9647	0.2204	0.4627
fatheredu	0.08949	0.03310	0.07409	-0.10809	-0.00051	0.05926	-0.00996
	0.0666	0.4982	0.1291	0.0266	0.9917	0.2250	0.8385

	IQs	marriageo	marriagess	unionmemo	unionmemss	exage	exsage
exage2	-0.00187	-0.00784	-0.00959	-0.06364	-0.06690	0.99924	0.14743
	0.9695	0.8726	0.8445	0.1925	0.1707	<.0001	0.0024
exsage2	0.03167	0.03912	-0.04214	0.05597	0.00284	0.15098	0.99319
	0.5170	0.4233	0.3884	0.2519	0.9537	0.0019	<.0001
extraversio	-0.08727	0.11737	0.00310	-0.05254	-0.02621	-0.01998	-0.04376
	0.0736	0.0160	0.9494	0.2822	0.5918	0.6827	0.3705
extraversiosib	0.00826	0.04436	0.05783	-0.02815	0.01455	-0.02008	-0.05765
	0.8658	0.3639	0.2364	0.5646	0.7660	0.6812	0.2379
agreeablenes	-0.06424	0.16295	0.02562	0.03668	0.02354	-0.07867	-0.10434
	0.1883	0.0008	0.6001	0.4528	0.6301	0.1070	0.0323
agreeablenessib	0.11837	-0.03706	-0.05504	0.08243	-0.07774	-0.02118	0.03535
	0.0151	0.4482	0.2598	0.0912	0.1112	0.6648	0.4695
conscientiousnes	-0.00097	0.07945	-0.03562	-0.11412	0.00921	-0.09152	-0.04027
	0.9842	0.1035	0.4661	0.0192	0.8506	0.0606	0.4098
conscientiousnessib	-0.00410	0.01835	-0.02658	0.00713	-0.05717	0.15363	0.06344
	0.9331	0.7074	0.5865	0.8840	0.2418	0.0016	0.1939
neuroticis	0.00374	-0.08723	0.00158	-0.01137	0.03187	0.09129	0.04952
	0.9389	0.0738	0.9743	0.8160	0.5143	0.0613	0.3108
neuroticissib	-0.01967	0.00971	-0.10094	-0.02679	0.12799	-0.01905	-0.00610
	0.6873	0.8426	0.0384	0.5836	0.0086	0.6968	0.9006
opennes	0.05100	0.11863	0.06132	0.04560	0.01486	-0.00868	-0.02033
	0.2965	0.0149	0.2092	0.3507	0.7611	0.8590	0.6774
opennessib	-0.02114	-0.01093	0.05056	-0.00730	-0.07170	-0.02781	0.01070
	0.6654	0.8231	0.3007	0.8813	0.1419	0.5694	0.8267
parincome	0.02783	0.04205	0.02904	0.00192	-0.05354	0.04847	0.04911
	0.5691	0.3895	0.5523	0.9686	0.2731	0.3211	0.3147
fatheredu	-0.01441	-0.00766	-0.02383	0.02496	0.00153	-0.07086	0.09687
	0.7682	0.8755	0.6258	0.6095	0.9751	0.1467	0.0470

	exage2	exsage2	extraversio	extraversiosib	agreeablenes
exage2	1.00000				
exsage2	0.14935 0.0021	1.00000			
extraversio	-0.01846 0.7056	-0.05001 0.3059	1.00000		
extraversiosib	-0.01770 0.7172	-0.04932 0.3127	0.03307 0.4986	1.00000	
agreeablenes	-0.07776 0.1111	-0.10833 0.0262	0.19567 <.0001	0.05256 0.2819	1.00000
agreeablenessib	-0.02095 0.6682	0.04073 0.4046	-0.04377 0.3703	0.15777 0.0012	-0.03171 0.5165
conscientiousnes	-0.09421 0.0534	-0.03796 0.4373	0.19909 <.0001	0.03726 0.4457	0.23390 <.0001
conscientiousnessib	.1563 0.0013	0.07477 0.1256	-0.00361 0.9412	0.24395 <.0001	0.00394 0.9357
neuroticis	0.09029 0.0642	0.05139 0.2928	-0.33668 <.0001	-0.09836 0.0437	-0.24826 <.0001
neuroticissib	-0.01723 0.7244	-0.00462 0.9246	-0.09015 0.0646	-0.15020 0.0020	-0.01594 0.7444
opennes	-0.00940 0.8474	-0.02448 0.6164	0.26098 <.0001	0.10010 0.0401	0.05653 0.2471
opennessib	-0.02748 0.5740	0.00622 0.8987	0.00979 0.8413	0.20838 <.0001	0.05605 0.2512
parincome	0.04714 0.3346	0.05616 0.2502	0.06371 0.1920	0.02479 0.6119	-0.02872 0.5567
fatheredu	-0.07356 0.1319	0.08800 0.0713	-0.01581 0.7463	0.02126 0.6635	0.06533 0.1809

	agreeablenessib	conscientiousnes	conscientiousnessib	neuroticis
agreeablenessib	1.00000			
conscientiousnes	-0.01304 0.7897	1.00000		
conscientiousnessib	0.37168 <.0001	0.07340 0.1327	1.00000	
neuroticis	-0.01711 0.7262	-0.29947 <.0001	-0.04796 0.3263	1.00000
neuroticissib	-0.31805 <.0001	-0.07298 0.1349	-0.16046 0.0010	0.08046 0.0992
opennes	0.02347 0.6311	0.10499 0.0313	0.02245 0.6460	-0.29202 <.0001
opennessib	0.04573 0.3493	-0.00934 0.8485	0.10058 0.0391	0.01877 0.7010
parincome	-0.04397 0.3681	0.08774 0.0721	0.01157 0.8128	-0.08318 0.0883
fatheredu	-0.08834 0.0702	0.00037 0.9939	-0.04303 0.3785	0.01214 0.8038

	neuroticissib	opennes	opennessib	parincome	fatheredu	motheredu
neuroticissib	1.00000					
opennes	-0.06084 0.2128	1.00000				
opennessib	-0.20810 <.0001	0.06477 0.1847	1.00000			
parincome	-0.04288 0.3802	0.03431 0.4826	0.04863 0.3196	1.00000		
fatheredu	0.04536 0.3532	-0.02174 0.6565	-0.00807 0.8689	0.04558 0.3508	1.00000	

	lnincom	lnincomes	educatio	educations	age	ages	IQ
motheredu	0.07556	0.06641	0.04738	-0.09546	0.06547	-0.01671	0.00234
	0.1216	0.1738	0.3322	0.0503	0.1800	0.7324	0.9618

	IQs	marriageo	marriagess	unionmemo	unionmemss	exage	exsage
motheredu	-0.04388	-0.03882	-0.01578	0.06304	0.00895	-0.02836	0.01934
	0.3691	0.4269	0.7469	0.1968	0.8547	0.5618	0.6923

	exage2	exsage2	extraversio	extraversiosib	agreeablenes
motheredu	-0.02976	0.01334	0.02639	-0.00575	0.06074
	0.5425	0.7849	0.5893	0.9063	0.2136

	agreeablenessib	conscientiousnes	conscientiousnessib	neuroticis
motheredu	-0.02686	0.02223	0.01273	0.02842
	0.5826	0.6492	0.7946	0.5609

	neuroticissib	opennes	opennessib	parincome	fatheredu	motheredu
motheredu	0.04133	-0.01184	0.01959	0.00431	0.62461	1.00000
	0.3976	0.8086	0.6886	0.9298	<.0001	

VITA

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Candidate for the Degree of

Doctor of Philosophy

Thesis: AN INQUIRY INTO THE EFFECTS OF PERSONALITY VARIABLES ON THE ECONOMIC RETURN TO EDUCATION

Major Field: Economics

Biographical:

Education: Received Bachelor of Science degree in Labor Economics and Industrial Relations from Ankara University, Ankara, Turkey in June 1992. Received Master of Science degree in Economics from Texas A&M University, at Commerce, Commerce, Texas, in May 1996. Completed the requirements for the Doctor of Philosophy degree with a major in Economics at Oklahoma State University in May 2001.

Experience: Raised in a village near Tokat, Turkey, during summers worked on family farm throughout the years of childhood, high school and undergraduate education. By Higher Education Council (HEC) of Turkey, granted a scholarship to pursue education towards master and doctoral programs in June 1993. Hired by Abant Izzet Baysal University, Bolu, Turkey as a research assistant in August 1993. Granted a research assistantship, 2000-2001 academic year, Oklahoma State University, Department of Economics.