RETURNS TO EDUCATION AND MALE-FEMALE WAGE DIFFERENTIAL IN ETHIOPIA:

An Analysis of Urban Household Survey

BY

ABEBE ALEBACHEW

Addis Ababa University
June, 1998

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A THESIS
PRESENTED TO THE SCHOOL OF GRADUATE STUDIES
ADDIS ABABA UNIVERSITY

IN PARTIAL FULFILMENT OF THE REQUIREMENTS FOR
THE MASTER OF SCIENCES IN ECONOMICS
(HUMAN RESOURCE ECONOMICS)

BY
ABEBE ALEBACHEW

MAY, 1998

ADDIS ABABA UNIVERSITY
School of Graduate Studies

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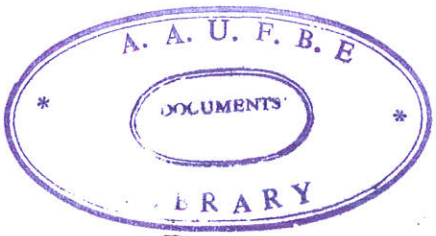


By
Abebe Alebachew Asfaw
Faculty of Business and Economics

Approval by Board of Examiners:

Ato Getachew Yoseph Advisor	Signature
Dr. Mulat Demeke Examiner	Signature
Dr. Andre Croppenstedt Examiner	Signature

ACKNOWLEDGEMENTS

This thesis could not have come in this form had it not been for the support of many people. First of all I would like to express my gratitude to my advisor, Ato Getachew Yoseph, for his guidance and valuable advice. My sincere thanks also goes to Dr. A. Croppenstedt, Ato Shimelis Worku, Ato Minyashal Beyene and Ato Eshete Yilma for their valuable comments on the draft document. I would like to thank the Department of Economics and Ato Tesfaye G/Sellassie for providing me access to the urban household survey data. Ato Tesfaye G/Sellassie has also advised me on how to deal with the data during the course of the study. W/t Aynalem Meshesha had taken care of all the painstaking secretarial service required. She deserved to be thanked for that. I should also thank all my friends and colleagues who provided the encouragement and support.

My heart felt thanks also goes to my wife Sisil Belay not only for her encouragement during the preparation of this paper but also for her understanding and support during the entire programme. My daughter Hilina has provided me a valuable diversion at the later stage of this study which I liked it very much.

I would like to express my gratitude to my sponsor, the Ministry of Economic Development and Co-operation (MEDaC) for making available the necessary backing for my study. Last but not least, I thank the African Economic Research Consortium (AERC) for granting the research fund.

ABSTRACT

The main objectives of this study are to estimate and analyse the private returns to education and to look into the existence of gender discrimination in the Ethiopian Labour Market. The methodologies used to that end are the OLS, the Heckman's two-step and the MLE two-step procedures.

The main findings of the study are the following. Educational investment is paying to an individual. One year of additional schooling, primary, secondary and higher education is found to have a return of 10, 5, 10.6 and 31 percent respectively. These estimates show that the private return to primary education is the lowest. No significant difference is observed between the private returns to males and females indicating that the existing disparity in enrolments is not explained by returns to education. Family background in the form of maternal education has been found to have significant impact on children's earnings implying that females' education has transgenerational effect. The observed wage differential in the Ethiopian Labour Market is mostly explained by differences in productivity enhancing attributes rather than by discrimination.

There are important policy implications to be drawn. Mere expansion of primary education may not result in improving the living standards and efforts should be made to revitalise its quality and relevance to the world of work. The government's intention to introduce cost-sharing arrangements at higher education is an optimal policy response to existing economic incentives. Improving female enrolments not only will reduce the wage differential between males and females but will also have a long-run economic benefit. So, resources should be committed to that end.

TABLE OF CONTENTS

List of Tables

CHAPTER 1

I. INTRODUCTION

1. 1 Background

Governments in many developing countries have been investing on education and training on the belief that investment in education can achieve multiple goals. It has a direct impact in terms of contributing to growth by generating and nurturing the necessary skills and knowledge. Education has a multiplier effect on non-market benefits such as the reduction fertility, improved health and nutritional status. By creating economic opportunities, education has also an effect on reducing income inequality. Due mainly to the above reasons, many governments in many countries spend a large share of their budget on education.

The time that education was established as key to solving many development problems is a distant past. Education continues to play a vital role (schultz, 1988:565) but there are arguments and counter arguments as to what extent governments should involve in financing education.

The classical arguments for public financing of education revolve around the perception that education is a merit good, has an externality, and is subject to diminishing costs. It shows leads and lags and principal-agent relationship, promotes equity, and is characterised by low private demand (Colclough 1996: 55). Opponents counterargue that education should be financed through the market mechanism, because government intervention does not necessarily lead to efficient allocation of resources between sectors or within the educational sub-systems and that resources for expansion may not be available from the public sector; (Colclough, 1996: 590).

Regardless of all counter arguments presented in the economic literature, most governments invest a large proportion of their budget in the education sector. The share of educational expenditure in the overall budget in Ethiopia, for example, has increased from 8 percent in 1987/88 to about 13% in 1995/96. This expenditure constituted about 3.6 percent of GDP (Policy and Human Resource Development(PHRD), 1996).

Currently the Ethiopian government is preparing a five-year Sector Development Program (SDP) in collaboration with donor agencies. The ESDP (Education Sector Development Program) has, among others, the objective of expanding access to education, improve quality, and improve disparities by increasing enrolment ratios of girls to boys and of the rural to

urban population. To realise these objectives, the government has planned to invest 11,137 million *Birr* on education in the next five years (MOE, 1998, P. iv).

In the context of an individual, who invests on his/her education, or by parents for that matter, education is an investment of current time and money for expected future pay (Freeman, 1986, p.367). Although education has a consumption component, the central theme that urges parents to invest on their children's education is the better pay that educated individuals generally command when they join the labour market. In other words, earnings in the labour market are considered as the return to investment in human capital. Hence, even though educational facilities are there to provide service through government investment the demand for education may not be forthcoming due to the high opportunity cost of sending children to school. The drive to expand education, therefore, needs to be looked at in relation to the private return to education.

Ethiopia has an extraordinarily low enrolment rate. The gross enrolment ratio (GER) for all level of education is 17% (PHRD, 1996: 10). Not only the GER is low, but the Ethiopian education system is inefficient with successive grade repetitions and high drop-outs from the school system. The high opportunity cost of students is singled out as one of the important factors responsible for low participation in the rural areas. 68.4% of the sample respondents in a rural household survey, for example, confirmed this assertion (PHRD, 1996: iii). Although households (70% of respondents) give a positive value for education, their financial contribution is not significant. They cover only 19.1% of the recurrent cost of the educational system (PHRD, 1996: 69). Stefan Dercon estimated the education expenditure per capita private expenditure per year in Ethiopia to be 3 birr (MOF, 1996: 580).

All the above figures and facts show that the Ethiopian educational system is faced with many constraints of which the lack of adequate investment by households on education seem to be the most important. Such lack of investment could be explained by the lack of adequate income to finance education or by the low level of returns to investment in education. It is therefore imperative to assess household decision making process and its rationality when families decide to enrol their children.

One of the distinguishing features of the Ethiopian educational system is its enrolment bias against females. When disaggregated by sex, the GER is 20 for boys and 15 for females (PHRD, 1996). A recent data presented in Table 1 elaborates the existing gender disparity more clearly

Table 1
Participation Rate and Gender Parity Index,
1992/93 - 1995/96

Year	Boys	Girls	Total	Gender Gap	Gender Parity Index
1992/93	23.2	16.2	19.7	7.0	0.7
1993/94	31.9	17.9	22.8	14.0	0.56
1994/95	35.7	22.1	29.0	13.6	0.62
1995/96	43.2	25.6	34.6	17.0	0.59

Source: M0E, Program of Action for ESDP, Jan. 1998:11.

Despite the efforts made by the government and other interested groups to increase female enrolments at various levels, the gender gap in participation rate has been widening rather than narrowing. Consequently, more boys are now coming to school as compared to girls. The causes for such a record could be many. The low participation rates by females may be due to a rational response by households to the lower rewards by the labour market for women. It may also be a result of cultural and other non-economic factors. It is, therefore, imperative to examine whether there is a gender differential in returns to education. If it is established that there is such gender differential, it will be necessary to identify the source of this differential and come up with the relevant policy recommendations as this will have implication to the overall economy. If males get higher returns to schooling than females, the greater schooling attainment among males in Ethiopia may reflect an efficient but inequitable household allocative response to scarce resources. If on the contrary, the reverse is true, the greater schooling of males relative to females would represent a serious misallocation of resources.

The Education and Training Policy of the government furthermore clearly stipulates that the priority will be to provide support up to the completion of general secondary education with increased cost-sharing at higher levels (Education and Training Policy, 1994).

The impact of cost recovery measures to changes in demand for education can be assessed using two ways. The first is by analysing the price responsiveness of educational demand through price elasticity and the second approach is to estimate the changes in demand by calculating the impact of such policies on perceived private rate of return to education. When the return drops below the returns in alternative activities, families are expected to refrain from investing in education (Emanuel Jimenez, 1987: 46-47).

Government policy will only be successful when the private return to higher levels of education is well above the alternatives. Even then, the effect of direct educational cost on returns is substantial. It is, therefore, important to see how large the returns to higher levels

of education in Ethiopia are; compare these magnitudes between lower and higher levels of education; and see whether the policy is justified in view of the government's objective of cost recovery and the individuals private return from higher levels of education.

Different estimates on return to education in Ethiopia are available. Wolday's 1986 and 1996 studies, for example, are based on sample firms rather than sample households and therefore may be faced with selectivity bias and the parameter estimates therefore could well also be biased. Moreover, the studies do not account the effect of families on knowledge, skills, values and habits and consequently earnings of children.

A glance in any socio-economic statistics reveals that there is discrepancy on earnings among socio-economic groups. For example, it is usual that average female wages are lower than males. This fact is confirmed in the Ethiopian statistics too. This is true for manufacturing industries in Ethiopia. Men on the average earn about 30 percent more than females (see Zewdie and Abebe, 1992). This gap could emanate either from differences in productive attributes or from differences in payment structures.

If the gap mainly originates from pay structures, the impact will not be limited to welfare of women but will spill over to the economy as a whole. In a free market system prices including wages are the prime signals for efficient allocation of resources in an economy. If wage payment differential persists, then the labour market could fail to allocate labour efficiently and there will be no Pareto efficiency.

The empirical evidence produced by Appleton, Hoddinott and Krishnan (1996) explained some of the wage gap in Ethiopia by gender discrimination in the labour market. This is one piece of evidence and it needs to be verified or rejected with a different data set to add to the stock of existing empirical knowledge in Ethiopia.

1.2. Objectives of the Study

The objectives of this study are as follows.

1.2.1. Estimating and analysing the private returns to education: Estimation of the rate of return for all levels of education will be undertaken. The existence of gender differential in returns to education will be examined and the extent to which families are rational in their decision when they enrol their children will be assessed. The effect of family background on children's earnings will be looked at and analysed to shed light on whether paternal or maternal education

contributes more to children's earnings. The effect of other forms of human capital formation will also be controlled.

1.2.2. Investigating male-female wage differential: Assessment of whether there is male-female wage differential in Ethiopia will be conducted. If it is found that there is wage differential, analysis will be made on whether such wage gap is attributed to labour market segmentation or preferential treatment of parents in human capital formation. Relevant policy recommendations will be drawn.

1.3. Hypothesis

1.3.1. The return to education in Ethiopia for women is at least equal to their male counterparts.

1.3.2. Looking at some of the labour market regulations and customary working arrangements, much of the observed wage gap in the Ethiopian labour market could be explained by differences in human capital formation rather than labour market segmentation.

1.4. Methodology

The method to be used in this study is basically quantitative. However, qualitative inferences from the available data and estimated results are not to be avoided. Simple averages and standard deviations will be used to compare and contrast major socio-economic groups' descriptive statistics. The multiple regression model will be applied to determine the returns to various characteristics of individuals. Chow and Wald tests will establish the existence of gender differences in returns to education. The Oaxaca - Ransom (1994) and the Cotton (1988) method of analysing wage differential will be employed to identify the main sources of the wage gap.

In the course of the study various econometric problems such as biases due to binary dependent variable, selectivity bias and simultaneity are likely to arise. The probit/logit function, ordinary Heckman and maximum likelihood two-step Procedures, and appropriate exogenous proxies will be used to take care of these problems.

1.5. Sources of Data

The data source of this study is the Ethiopian Urban Socio-Economic Survey of September 1994 collected by the Department of Economics of Addis Ababa University and the University of Gotemborg. The data provide detailed socio-economic information on about 9,200 individuals. The survey covers 7 major urban centres in the country. The study will also use secondary data sources to supplement the survey whenever the need arises.

1.6. Limitations of the Study

As the study, once again, is mainly based on the data generated by the household survey conducted by the Addis Ababa University, the paper will have the following limitations:-

- Even though every attempt is made to use the available information as real variables or proxies for some variables, there may be problems of incomplete and/or missing data and sometimes errors in variables. These problems will be one of the weak links in this study.

- Household surveys in any country will not contain all the necessary behavioural characteristics that are essential for such studies. For instance, in this study, ability, responsibility, motivations are important determinants for success in the labour market. Unfortunately, such factors are difficult to capture through household surveys and they are omitted in many empirical studies. These problems can be tackled by administering special type of surveys like intelligence test, aptitude test, personality test, which use open ended questions or focus group interviews rather than formal interviews relying heavily on predetermined, close ended questions. To carry out such an analysis needs time and money which is not provided for in this study. Hence, ability and similar behavioural factors are missing in the analysis and may create some bias in the estimated parameters.

CHAPTER - 2

II. RETURNS TO EDUCATION

Ever since the concept of human capital evolved into the economic literature, the interest to estimate the returns to such capital has been growing. There are now many empirical evidence on returns to education for many developing countries. The effort made in Ethiopia in this regard is rather limited. The empirical researches made are few and some have econometric problems. The data set they use is of firm specific and consequently could not be taken as a reflection of the national situation. It is therefore hoped that this paper would bridge this gap.

This chapter reviews the theoretical background, and the empirical evidence produced in developing countries in general and in Ethiopia in particular. It also describes the data set to be used and specifies the model of the analysis. Estimated results will be presented in the final section of the chapter.

Before going to the theoretical background of the study, it is important first to clarify one of the basic assumptions used in valuing labour. It is difficult to assign a value to the output of labour per hour in self-employment, home production or leisure. In such instances, it is common to use wages of labour market participants as a return for specific characteristics of workers, and then correct for selectivity (Schultz,1997:145). In this analysis, individuals who are not working for wages are assumed to value what they produce with their time more highly than the market wage rate. Therefore, how individuals allocate their available time should not necessarily influence the private return to their human capital.

Basically wages can be determined through the demand side by looking at the behaviour of firms and which qualities they reward most when they hire workers. It can also be determined through the supply side by analysing which specific characteristics of employees are being compensated by higher wages i.e., hedonic pricing of wages (Groataert, 1988 : 209). The wage determination models from the demand side analysis include "labour turnover", "self selection", "subsistence wage" and "efficiency wage" models.

Since the data this study is going to use is a household survey, which is basically dealing with the supply side, the theoretical and empirical literature associated with the demand side will not be treated.

2.1 |Theoretical Background

Estimation of the rate of return to education historically began not from theory but rather from fitting the data to statistical earning functions. The exercise was intended to find the functional form of the earning functions that best fit the data. The statistical earning functions used can be represented as,

$$y = f(s,k) + \mu \qquad (1)$$

where, y represents annual earnings, s years of schooling, k is potential years of experience and μ is the residual with mean zero. Using such statistical functions Becker (1962, 64), Hanoch (1976), Hanson (1963) and others have estimated the internal rate of return to education (Willis, 1986: 526). Although the ideal data set for statistical earning functions and internal rate of return calculations is complete longitudinal life histories of earnings of individuals, they are rarely available and most studies were and are using cross-sectional data. However, cross sectional data often do not contain information on direct cost of education. As a result simplifying assumptions are made for estimation. Often, the major assumptions made are that the only cost of schooling is foregone earnings and that the educated individual enters into the labour force immediately after completing schooling.

One of the problems of statistical earning functions is the problem of self-selection. It assumes that these statistical earning functions correctly reflect the opportunity set faced by individuals. There are, however, a lot of unobserved characteristics that may be correlated with education and create bias in the estimated parameter. In this regard,

> If the full opportunity set cannot'be observed and opportunities vary across agents, then the act of optimal choice implies that market data are systematically censored and there is no guarantee that estimates based on interpersonal differences in earnings and schooling will accurately estimate the opportunity set of any individual in the population (Willis, 1986: 535).

The era of statistical earning function superseded with the development of the human capital earnings' function. Becker initiated the move with his seminar work on human capital and Mincer provided the tool by developing an earning function that is consistent with economic theory.

Although the importance of human capital and education in particular has been the subject of discussion since the days of Plato, the complete price-theoretical analysis of individual's investment in human capital was developed by Becker (1964) (Tilak, 1989: 10). According to Becker, education is an investment like other forms of physical capital that has the

opportunity cost in terms of time and money and need to be compensated by higher returns during employment.

Education is demanded as a consumer and producer good. It is demanded as a consumer good because it yields direct utility. It is also demanded as a producer good because it is expected to enhance the future productivity of an educated individual (Schultz, 1988: 557). In spite of the fact that human capital theory recognises the consumption value of education, the theoretical argument heavily rests on education as producer good. As a produced means of production, the private and social demand for education is an increasing function of its private and social rate of return (Becker, 1993).

At aggregate level, human capital formation improves the quality of labour force that is reflected in its health and nutrition, skill and education. This aspect of human capital formation is an important aspect of development. Four major reasons are given as to why human capital is important. First a healthy and educated population is an end in itself. Second human capital is a direct input into the production process. Third it is complimentary to other physical inputs. And fourth human capital is necessary for technical change (Griffin, 1989:233).

The above line of perception leads to the belief that education contributes to national output and hence economic growth. In this context, there are three differing points of views of education- the screening, fixed coefficient bottleneck and the human capital -which provide different thoughts on education-growth link. The screening view argues that wage differentials overestimate the productivity gain to the society from education because the private gain associated with the signalling role of education to the employer is not a social gain. The fixed - bottleneck view emphasised that economic growth requires a certain combination of educated labour, the shortage of which will cause bottleneck problems (Freeman, 1986: 358).

The human capital theory views education as productive input, the contribution of which in competitive market is measured approximately by wage - differentials between less and more educated labour.

The controversy between the human capital theory and screening views over the effect of schooling on productivity and growth led to the issue of growth accounting. Based on the arguments of human capital, the basic growth accounting model boils down to the following form.

$$Q = f(E, K) \quad \text{.....(2)}$$

where, Q = Output
E = Effective units of labour and
K = Capital

Education is assumed to increase the effective units of labour. Although the effective units of labour can be expressed in terms of education in several ways, the simplest and widely used way is to define E as,

$$E = \sum_{i=0} \{W_i / W_0\} E_i \quad \text{..... (3)}$$

where, Ei - number of workers in the i^{th} educational group.
Wi - wage of workers in the i^{th} category.
Wo - is the numeraire category.

Assuming that labour and capital are paid their marginal productivities, and that the equation (2) is constant returns to scale, the basic growth accounting can be obtained.

$$\dot{Q} = \alpha_L \dot{E} + (1 - \alpha_L) \dot{K}, \quad \text{.....(4)}$$

Different researchers have used the above growth accounting model and produced several empirical evidence in support of human capital theory (to be discussed later). In spite of such evidence, the screening model contends that the effect of education on productivity is less than what is implied by the above model (Freeman, 1986: 359). Education is only important, they argue, to distinguish able and non-able workers. Any schooling beyond establishing such differences among workers has no productive value. The opponents of this view argue that unless education has a productivity value, it would be an expensive way of screening and society would have otherwise developed a different sorting mechanism (Schultz, 1988: 582).

Empirical evidences produced so far have been relatively scarce and has not resolved the issue. This is mainly due to the difficulty of developing clear-cut tests. Test for screening and human capital hypothesis has taken many forms (for the survey see Freeman 1986, and Schultz 1988). But Freeman concluded that "overall, while neither the studies focusing on screening/signalling nor those focusing on the direct productivity yielded definitive results" (Freeman, 1986: 362).

The human capital theory is more appealing when one looks at it from the individual's context. Education is an investment of time and money for a better pay in the future. An

individual faces the choice every year either to work full time or going to school full time and invest on oneself. If one chooses to go to school, the return from the labour market, that he would have participated in, would be his foregone opportunity. This is the cost. The expected better pay that he/she will command immediately after joining the labour market and thereof is the return. The individual, as a rational being, will invest on education as long as the benefits are more than the costs. Hence he/she will optimise his/her length in school up to a specific period where the marginal cost and the marginal benefits of education are equalised.

As a result of rational decision-making and risk taking, people could accumulate different stocks of human capital depending on their innate ability, the type, amount and quality of education. This results in a wide variety of groups, subgroups or individuals who are not readily substitutable for each other in the labour market. Such human capital heterogeneity produces wage differentials due to varying productivity differentials.

Although this will be shown in detail in section three of this chapter, it is desirable to formally derive the quantitative descriptions of the theoretical background. In the preceding paragraphs it is specifically pointed out that the human capital theory links earnings and education. In the simple model of human capital theory, therefore, the rate of return from educational investment can be calculated on the basis of the following equation.

$$\int_0^n W_{te}^{-rt} = \int_s^{ns} W_{st} e^{-rt} + \int_0^s (W_{st}^{i} - D) e^{-rt} \quad \text{..... (5)}$$

where,

W_{te}	=	earnings for persons without education,
r	=	rate of return to investment in education,
n	=	number of years non-educated persons work,
W_{st}	=	earnings for persons with education,
n_s	=	number of years educated persons work,
W^i_{st}	=	earnings for persons during education period,
D	=	direct cost of education, and
S	=	number of years of education.

The first term in equation (5) is the present value of earnings for non-educated persons. The second term is the present value of earnings for educated persons after graduation. And the last term measures earnings, net of direct cost of schooling, during school (Freeman, 1986: 376). With the assumptions that,

- net earnings during school is to be zero,
- earnings do not change with age or experience and

- educated workers would retire s years later than less educated workers,

equation (5) would be reduced to

$$\int_0^n we^{-rt} = \int_s^{n+s} W_s e^{-rt}$$

OR .... (6)

$$\frac{W_s}{W} = \frac{e^{-r(n+s)} - e^{-rs}}{e^{-rn} - 1} = e^{rs}$$

Taking logs, we get

$$\log w_s = \log W + rs \text{.......................................(7)}$$

The schooling coefficient r is interpreted as an estimate of the private return of schooling investment.

Equation (7) is the simplest model and it has been modified and adjusted by including relevant variables into the model. Since this part will be dealt with later in detail, the formulation exercise will not be extended any further in this section here.

The critics of human capital theory argue that the higher pay received by the more educated persons reflects the operation of credentialism. They argue that information about the workers' productivity is distributed asymmetrically between workers and employers (workers know their productivity but firms do not). Education affects earnings, primarily not by altering the productivity of individuals, but by grading and labelling them in such a way as to determine their job placement and earnings. Employers use education as an inexpensive way of identifying workers who are likely to be of high quality. Therefore, the incremental income enjoyed by college graduates might be a payment for having credentials rather than a reward for being more productive. The role of education, therefore, is to provide signal to employers that able individuals will invest in their education more than the less able (Willis, 1986: 591)

Thus, various researchers use different formulation to test the relevance of human capital versus screening hypothesis. The years of schooling an individual spent in schools measures productivity and the various credentials associated with various levels of schooling on the other hand represent signalling ability to the employer.

Viewed from the private perspective, the screening view would have no effect upon the private rate of return. Whether one obtains a higher paying position because of knowledge and skills acquired or because he/she possesses the necessary credentials, attending school remains the reason for higher earnings. It is only the reason for rewarding education that separates these two hypotheses. Estimating the private rate of return to education and interpreting it according to the relevant hypothesis is possible.

2.2 Review of Empirical Literature

Investing on human resources has become at the centre stage of development and is being considered as one of the "basics" of development (Kedija Haq, 1986; World Bank, 1992). Investing in people is a critical factor in efforts geared towards generating sustained growth and alleviating poverty. Evidences have been produced to substantiate the issue.

Researchers use various methods to establish the education - economic growth nexus. The methods used include simple historical narration, simple correlation, residual methods, production function method, growth accounting equations and the rate of return calculations. Despite the methodological differences, most studies, with few exceptions, have established a positive education - economic growth link.

Solow (1957) and Svennilson (1964) attributed the unexplained portion of economic growth to "technical progress". In his pioneering work, Denison (1962) established the education-growth link. He showed that significant part of the residual, which was earlier attributed to technical progress, is the contribution of education. Since then, similar evidence are produced. These studies have found that education contributes between 21- 42% (see Table 2) of the residual growth in GNP in various countries (Danison 1962, 1974; Griliches and Jorgenson 1966, Griliches, 1964 and 1970; Kendrick, 1977, 1981; and Jorgenson, 1984).

Following the development of growth accounting models, the contribution of education to economic growth was directly estimated. Survey made of Psacharapoulos first generation estimates depicts that the contribution of education ranges from 0.8 percent to 25 percent. His estimates also show that the contribution of education declines as a country moves higher in the income ladder (see Table 3).

Table 2

The Contribution of Education to Growth

Researcher	Country	Contribution of education to growth
Danison (1962)	USA (1909-29)	23%
	USA (1929-57)	42%
Danison (1974)	USA (1948-73)	21%
Jorgenson (1984)	USA (1948-76)	15-25%

Source: Tilak, 1989: 13.

Psacharopoulos (1984) estimated the contribution of education to growth in 29 countries and his results were summarised by Tilak and is presented below.

Table 3

Contribution of Education to Economic Growth by Region

Region	No. of Countries Considered	Percentage of growth rate explained by education
Africa	3	17.2
Asia	4	11.1
Latin America	9	5.1
North America	2	20
Europe	11	6.5
All Countries	29	8.7

Source: Tilak, 1989: 14

Recent econometric researches have also shown that literacy and education do contribute to economic growth. Hicks (1980) analysed the relationship of literacy and economic growth by using data from 83 countries and found out that a 20% increase in literacy is associated with 0.5% higher growth rate. Wheeler (1980), using data from 88 countries, has found a stronger relationship in which an increase in literacy from 20 to 30 percent resulted in real GDP growth from 8 to 16%. Marris's (1982) finding not only reaffirmed the importance of education but also shaded light on the weak role of physical capital investment unless it is supported by education. (For detailed review of such empirical evidence see Tilak, 1989.)

A more recent study conducted by Lau, Jamison, Liu and Rivikin (1993), using meta-production function methodology, has added new evidence on how much education contributes to growth. They concluded that

> ... average education of the labour force has a large positive and statistically significant effect on output. One year of average additional school is estimated to increase real output by approximately 20%. However, there is also evidence that ... existence of a threshold of minimum average education... for education to begin to have an impact (Lau and et.al, 1993: 65.)

Their evidence suggests that the level of investment in education required before it has any effect on output can be quite high and the gestation period could be long.

Netsanet (1997) has established the same fact for Ethiopia. He used error-correction model to look into the short run and long run dynamics. He found out that both in the short and long run education enters positively and significantly in explaining output. The contribution of primary education is found to be relatively large when compared with higher levels of education in both cases (Nestsant, 1997: 18).

Admit (1997) tried to see the impact of schooling on productivity in the Ethiopian manufacturing industries. His results show that schooling significantly influences productivity. The level of schooling has strong association with the level of productivity; and the higher the proportion of labour force with high level of schooling in an enterprise, the higher is its productivity (Admit, 1997: 21).

All the above empirical evidence support the contention that education and training are investment in human capital, provide the necessary skills, knowledge and behaviour required to improve the productivity of the skilled individual leading to economic growth at the aggregate level.

There are however other empirical evidence reported by other group of researchers that very much discount the role of education in improving production and productivity. This body of empirical researches have come up with the evidence that the role of education is limited to providing information for employers about the innate ability of prospective labour market entrants. Education they argue has only an informational role of screening people.

Using screening model, empirical evidences are produced by Kenneth Arrow (1962), Wales (1973), Taubmen and Wales (1978), Riley (1979), and others. Taubman and Wales have suggested that if the role of screening is excluded, the rate of return to education will be reduced by as much as 50%. Riley by differentiating "screened" and "unscreened"

occupations concluded that "the screenist interpretation ... indeed offers a more complete explanation of observed behaviour than the traditional human capital" (Riley, 1979: 5250 - 5251). The evidence produced by Lay and Psacharopoulos (1974), on the other hand, do not support the signalling hypothesis.

Neither the theoretical explanation nor the empirical evidence produced by researchers has enabled us to exclusively determine the role of education. The situation should therefore be examined on specific country by country basis. This does not, however, create an estimation problem on the private returns to education.

The private returns to education are estimated for many countries. These estimates show that the private returns are larger than the social returns and the returns to various levels of education are by far greater in developing counties as compared to developed countries. Studies also document that the average private return to education for developing countries to be 29 per cent for primary, 19 per cent for secondary and 24 per cent for higher education (see table 4 for details).

Table 4

Returns to Education by Region and Country Type

Region or Country Type	No. of Countries in the Group	Private Returns to Education		
		Primary	Secondary	Higher
Africa	9	29	22	32
Asia	8	32	17	19
Latin America	5	24	20	23
Developing Countries Average	22	29	19	24
Intermediate	8	20	17	16

Source: Willis, 1986:541.

The most notable of these estimates are produced by George Psacharopoulos. He produced four comprehensive reviews of the return to education for the last 20 years (1973, 1980, 1985, and 1994). By so doing he has influenced the World Bank and other donor agency policies. His results are the cornerstone of the World Bank's basic recommendations: Education is attractive investment; more returns could be realised from investment on primary education; and cost recovery schemes should be placed at higher levels of education (Bennell, 1996:183). George Psacharopoulos's estimates of rate of the return patterns throughout the world ,as summarised by Bennell ,suggest that

a) rate of return to education generally exceeds the aggregate social opportunity cost of capital;
b) rate of return to education in developing countries (and especially in Africa) is higher than in the advanced market economies;
c) the private and social returns are highest for primary, followed by secondary education;
d) private returns to higher education are usually considerably higher than the corresponding social returns, and
e) the pattern is stable over time with slight decline through progress (Bennell, 1996:183).

Table 5

Aggregate Social Returns by Level of Education and Year of Psacharopoulos's Review

Region	Review Year	Primary	Secondary	Higher
Africa	1973	28	18	13
	1980	29	17	12
	1985	45	26	32
	1993	24	18	11
Asia	1973	14	15	11
	1980	16	12	11
	1985	31	15	18
	1993	20	13	12
Advanced Countries	1973	NA	9	9
	1980	NA	10	9
	1985	NA	12	9
	1993	14	10	9

NA= Not Available

Source: Bennell, 1996:184.

These estimates are now being scrutinised and there are sceptics on the validity of these estimates for policy making in Sub-Saharan Africa on several grounds. First, the country coverage is quite limited. His 1994 update, for example, covers only 18 countruies. Second, most of the studies used have serious limitations on the quality of their data. Again, most studies are infected with three basic methodological weaknesses: sample selection, omitted variables and cross-sectional earnings data. For the critique of Psacharopoulos's work, see Bennell, 1996. Bennell concluded that "the 1994 review are so flawed that they should be discarded altogether in any serious discussion of educational investment priorities" and that "the conventional rate of return to education patterns almost certainly do not prevail in Sub-

Saharan Africa under current labour market conditions".(Bennell,1996:195). Hoddinot and et al have produced a contradictory result.

Few studies have attempted to estimate the differential returns to schooling for males and females in developing countries. These studies include Behrman and Wolfe (1990) for Nicaragua, Bridsall and Behrman (1990) for Brazil, Gannicott (1988) for Taiwan, Gindling (1988) for Brazil, Khandker (1990) for Peru, Behrman and Doelalikar (1990) for Indonesia, Visverberg (1993) for Cote d'ivoire and Simon Appleton & et al (1995) for Ethiopia, Cote d'voire and Uganda. Except for Behrman and Doelaliker, these studies have found that the returns to schooling do not differ significantly by gender.

Appleton and et al (1995) concluded that conditional upon participation in the public and private sector, there is no systematic evidence that returns to education is lower for women in Cote D'ivour and Uganda. Returns tend to be lower for women in the private sector in Ethiopia. They explained this differential by the limited nature of the private sector before 1991 (Appleton and et al, 1995). Behrman and Doelaliker, on the other hand, found higher returns to schooling, especially at higher levels, for females than for males (For the Survey see Doelalikar, 1995). Their results seem to be a product of their better methodology: the fixed effects model (see Table 6). This model has also produced empirical evidence that clearly shows the ordinary least square (0LS) estimates of the impact of schooling appear to have substantial biases that result in:

- an overall overestimate of the return to schooling,
- overestimate of the relative returns to the lower schooling levels, and an overestimate of the relative returns to schooling for males relative to females.

Table 6

The Marginal Effect of Years of Schooling on Wage in Indonesia

Years of Schooling	Males			Females		
	OLS	Fixed effects (%)	Upward bias of OLS (%)	OLS (%)	Fixed effects(%)	Upward bias of OLS (%)
3	6.4	3.2	98.9	6.7	5.3	26.9
6	7.8	5.2	48.9	10.0	9.8	2.3
9	9.2	7.3	27.0	13.3	14.3	-6.8
12	10.7	9.3	14.6	16.6	18.8	-11.5

Source: Behrman and Doelaliker, 1993, p. 467.

Empirical evidence shows that return to education also differs across sectors. Earlier studies that used a dummy variable or estimated a separate earning function between public and private sectors show that the private sector has a premium over the public sectors (Psacharopoulos, 1985); Carbo and Stelcner (1983). Studies that consider employment in a given sector as a choice variable, on the other hand, show that public sector has higher returns than the private sector [Van Der Gaag and Vijverberg (1988) and Assaad (1997)].

Estimates for returns to education in Ethiopia is produced by Wolday Amha in 1986 and 1996. In 1986 he found that the returns to schooling to be 9 percent when education is defined as continuous variable. When he disaggregated the level of schooling, he found out that the returns to primary, junior secondary, higher secondary, post secondary and post diploma to be 9.6, 11.7, 15.7, 27.6 and 14.7 percent respectively (Wolday, 1986: 73 and 78). His 1996 estimates are presented in Table 7. His analysis also shows that in Ediget factory the returns to male schooling are higher than females for diploma and above diploma while the reverse is true for primary and junior secondary schooling.

Table 7
Private Rate of Return to Schooling in Ethiopia and Ediget Cotton Factory

Level of Education	In Ethiopia	Ediget Cotton Factory
Primary	4.88	3.3
Junior Secondary	4.87	5.5
Senior Secondary		2.8
Diploma and Certificate	4.62	18.31
Above Diploma		11.3

Source: PHRD Study, 1996 : 24 and 25.

His analysis also shows that in Ediget factory the returns to male schooling are higher than females for diploma and above diploma while the reverse is true for primary and junior secondary schooling.

Although Pramla's exercise seems to support his exclusion, Wolday's analysis, however, does not take into account the influence of family background on earnings. His estimation procedure depends only on those that are employed in the formal sector of the economy and consequently the problem of selectivity bias could be introduced. The reliance on formal sector of employment for estimating the rate of return to education suffers from two problems: formal sector employment comprises only a relatively small percentage of labour; public sector dominate formal employment and there is a danger that individual's incomes may diverge from market productivities. This violates the basic assumption of human capital (Bennell, 1996:188-189). As long as many educated people remain unemployed or employed in the informal sector, estimating the rate of return by using samples across formal firms would definitely overstate average earning functions. Although his exercise has given some insight on the issue, because of the limited coverage of the data and the possible econometric problem indicated above, the parameter estimates may deviate from the actual returns. As a result, there is a need to extend his model and look into the implications of such specification.

Pramila Krishnan (1994) has estimated the impact of family background and education on earnings using the data from the "Survey of Adolescent Fertility Reproductive Behaviour and Employment Status of Youth Population in Urban Ethiopia" conducted in June 1990. She concluded that the returns to own education in both the private and the public sectors fall slightly with the addition of the direct effect of family background, but the difference is insignificant (Krishnan, 1994). Given the arguments for including parental background, this

result needs to be reconfirmed whether it is indeed true good home environment has no significant contribution to children's return from education.

Tesfaye Gebresillassie and Pramila Krishnan (1997) estimated the return to education and analysed its pattern over time and between sectors. They found that returns fell sharply at all levels of education in both sectors over time. This result indicated that returns are higher in the private sector as against the public one. While their estimates may be correct across time, their public-private differential estimate is suspect. Estimates that consider public-private sector employment as exogenous decision arrive at the same conclusion [Psacharapoulos (1985), Corbo and Stelcner (1983)]. If the market is segmented into public and private and if there exists a premium on one of them, employment decision is made in two steps. First, the employee offers himself/herself and second the employer in the preferred sector chooses whom to employ. In such cases, it is preferable to use a switching regression model. This exercise is, however, beyond the scope of this paper.

2.3. Model Specification

Since the main purpose of this chapter is to estimate the returns to education in Ethiopia, it is imperative to review the models and the justifications used so far in the empirical studies in order to specify the models that are going to be used in this study. Furthermore, some of the econometric problems that are likely to arise will also be raised.

Different researchers used different methods and data sets to estimate the returns to education. In this respect, there are two basic methods that have been used. The first is the "Full" or "elaborated" method that requires data on age-earning profile by level of education and then it tries to find the discount rate that equates the streams of education benefits to the streams of educational costs. The second method is to estimate the earning function and then extract from it the hedonic price of different characteristics (Psacharopoulos, 1994:1325).

Even though the elaborated method is the most appropriate method of estimating the returns to education, its data requirement is so extensive that it is rarely used in empirical studies. The alternative we have is only to use the earning function method.

Consistent with the human capital theory, Mincer (1974) has developed the human capital earning function for estimating the returns to human capital in empirical studies. According to the simplest version of this model "an individual decides between alternative schooling levels that maximises the present discounted value of earnings given the opportunity cost of time in school instead of the labour market and the rate of interest" (Behrman, 1990: 6).

The investigation of the labour market, therefore, requires an articulation of the labour supply, earnings and educational investment. Such a model determines the educational level chosen by an individual, and the level of labour supplied to the market. Such a model is termed as "human capital" model and could be written as,

$$Y = P_h H e^{\mu} \quad \text{.....(8)}$$

$$H = e^{\beta s} \cdot e^{v} \quad \text{.....(9)}$$

$$y = \ln(Y) = \ln P_h + \beta S + \mu + \upsilon \quad \text{.....(10)}$$

Where Y is the labour earning, H is the quantity of human capital, P_h is the rental price of human capital, μ is other influences on wages. Equation (9) is the production function of human capital using schooling(S) as an input; ability, efficiency etc., are represented by υ. Equation (10) is the traditional earning function.

This basic earning function assumes for simplicity that education is a given "type", lasts for a given number of years, full time; individuals are exactly identical in all respects; there is no direct cost to education; all workers have the same working life; there is no on the job training; and the market is perfect (Psacharopoulos and Tzannots 1992(1) : 159). Given these assumptions, the present value of life time wage of uneducated (w^u) and educated (w^e) worker at the point when they start working are respectively

$$PV_{\mu} = W_{\mu/r}(1 - e^{rT}) \quad \text{.....(11)}$$

$$PV_{e} = W_{e/r}(1 - e^{rT})e^{rs} \quad \text{.....(12)}$$

Given that individuals are identical, at competitive equilibrium in a perfect market, the two present values must be equal. Hence,

$$W_e = W_{\mu} e^{rs} \quad \text{.....(13)}$$

Taking the logarithm on both sides,

$$\ln(W_e) = \ln(W_{\mu}) + rs + \mu i \quad \text{.....(14)}$$

Equation (14) is a stable earning function in the long run under the condition of varying technology, capital stock and demand patterns. It only requires the interest rate to remain constant. Ln W_{μ} shifts as technology and resources vary. The assumption that all individuals should face the same interest rate (equality of opportunities) calls for the economic system to provide good access to finance, free entry to school and occupations (Willis, 1986: 561).

The result derived in equation (14) is compatible with common sense in that educated individuals should have greater wage than the uneducated. This is also a convenient relationship between earnings and length of schooling for econometric research that lends itself for a linear regression model.

One of the basic disadvantages of the above model is that it ignores all human capital formation after the end of formal schooling like on-job training. This observation is accommodated into the model with including experience as a proxy for post-education human capital formation. Hence, the most popular type of earning function can be represented as,

$$\ln(W_e) = \beta_0 + \beta_1 S + \beta_2 K + \beta_3 K^2 \quad \text{.....(15)}$$

where K represents the experience of the individual.

The square of experience is included in the earning function to represent the diminishing investment on the job training with experience.

There are several criticisms directed against estimating the private rate of return to education using the traditional human capital earning functions. Such criticisms can be grouped into two major categories: The first set of criticisms are viewed as revisionist because their entire intent is "to revise and reformulate the human capital concepts, to modify its empirical estimation using better estimating techniques and to collect more appropriate data" (T.P. Schultz, 1988: 582). This group raises the issue that:

- the traditional technique fails to control for family connection, ability and motivation.
- it failed to account for unobserved household and community variables.
- it failed to incorporate the quality of schooling.
- it failed to control for school dropouts and class repeaters.

Of the above mentioned omissions, the exclusion of ability, family background and the quality of schooling from the specification have been considered as serious omissions in the literature. These omissions lead to the well known "omitted variable" bias.

There is no direct measure of ability. But proxies are used to that end. Data on proxies of ability as IQ tests, intelligence test scores, on the quality of school attended are difficult to obtain even in developed countries let alone in developing countries like Ethiopia. Such data are usually difficult to obtain in household surveys that this study uses as a data base. Studies

conducted in the USA that incorporate ability testes so far use only three specially administered data sets.

Empirical studies that include ability in their methods followed two lines. Some studies use rough proxies. Others use relatives (twines) to control both genetic and environmental effects on earnings. Studies undertaken by incorporating, ability in their studies conduct especially designed and administered surveys that are very often rough proxies. Such an attempt is beyond the scope of this study. It is often argued that the omission of ability would create an upward bias in the estimated coefficients. The empirical evidence produced by J.C. Hause and D.A. Wise supports this argument (Psacharopoulos and Velez, 1992). On the other hand, economists disagree on the relevance of schooling ability on the employment arena. Intelligence tests or aptitude scores, school grades, and personality tests are relevant at times but do not reliably measure the talent required to succeed in the economic sphere (Becker, 1993 : 97). When these tests are faced with imperfection, the estimated result will remain biased even when ability is controlled (Willis, 1986:589)

Empirical findings reported by other researchers document the fact that the omission of ability in the earning function has not produced a significant bias. Griliches and Chamberlian (1975), working on brothers to control ability and compare it with non brothers have found that a brother with additional schooling does indeed earn more than the brother with less by amounts modestly different (5-10%) from those between non brothers (Freeman, 1986: 378). Mohan (1981) concluded that "the simple human capital based specification of earnings function does well in explaining the variance in earnings in Bogota and Cali (Moha, 1981: 47). He also found a consistent estimate for different years and for different levels of education.

Having reviewed a number of studies conducted on the question of the nexus among earnings-education-ability, Willis concluded that:

> Given the complexity of the issue and non-representative character of the data sets that have been employed in the literature on ability bias, it is difficult to reach any firm conclusions about the magnitude or even the direction of the bias.... My impression is that the simple Mincer-type earnings function does a surprisingly good job of estimating the returns to education (Willis, 1986: 590)

Another important omission is the quality of education. Behrman and Birdsall(1983) found out that the exclusion of quality of schooling would overestimate the returns to expansion of education and the estimates are not good guides to policy making in Brazil. The educational system in Ethiopia is using a standardised curriculum where every school should follow the

country's educational syllabus; the training of teachers is uniform; and the available teaching materials are uniformly scarce. Although there could be differences in quality of schooling particularly between the public and the private (which are very scarce) schools, difference in school qualities could not be as much as in Brazil where each state has different curriculum, term lengths and each state can employ teachers with different levels of training. Hence, despite the fact that the omission of school quality in Brazil resulted in an upward bias in returns to education, this does not necessarily mean the estimated bias from omitting the school quality will be as much as in Ethiopia as it was in Brazil. Because of lack of data and the belief that there is less difference in quality across schools, the quality of schooling is not included in the model.

The other important variable that is missing from traditional human capital specification is family background. It is argued that family background could affect the return to children's education for many important reasons. First, families could directly employ family members. second, nepotism and social stratification allow influential parents to place their children in favourable jobs. Third, more educated parents may provide the child with a more favourable learning environment. Fourth, the genetic transmission of ability from the parent to child could be proxied by parent's education. And finally parents could also finance the schooling cost of their children at different interest rates that have an impact on the children to be either present-or-future oriented (Schultz 1988: 588). Excluding parental background, therefore, is believed to create an upward bias in the estimated rate of return.

The omission of ability, school quality, parental background in isolation or all together would create an upward bias in estimated returns to education. One should also note that there are increasing gains in education from its impact on non-market or home production activities. Wilber and Griffin have pinpointed that these estimates do not consider the potential effect of educated people on the productivity of those around them or the health of families. These estimates also exclude the power of education to enrich the lives and capabilities of people in ways other than by raising the production of goods and services (Wilber and Griffin, 1992: 595). It is, therefore, extremely difficult to ascertain whether the effect of omitted variable bias will be upward or downward.

Another line of criticism against the conventional calculations of the rate of return to education is that it is not possible to exhaustively include all household and community characteristics. Omitted variables may correlate with years of schooling and the resulting parameters could not be free of bias. This line of reasoning differs from the previous one not in the identification of the problem but on how to deal with it. Proponents of this method advise the use of fixed-effects estimation against the simple OLS (Khandker, 1990; Behrman

and Doelalikar, 1993). Such estimates, they argue, control for all unobserved household and community factors.

The fixed effect model is more appealing than the traditional method but calls for a larger sample data set with two or more female and male household members participating in the labour market. The data set of this study has in total 1,500 households with 1414 labour market participant members. If we extract households with two or more participants only few households will remain in the sample. In spite of its advantage, it is unfeasible to apply this methodology in this paper for reasons of reduced sample size.

Consequently, because of the lack of data and because of the belief that there will be small biases arising from the omission of relevant variables, the paper uses the traditional human capital earning functions with some extensions. Given the above specification and criticism of human capital theory, our returns to education will be estimated using equation (8) with the following modification. In addition to the simple Mincerian explanatory variables (education and experience), different personal, family and employment characteristics will be controlled. Some of influencing factors included into the regression equation are potential experiences, its square, martial status, maternal and paternal education, health indicators (BMI and height), occupational category, firm size, remittance. Consequent up on this extension, the study will end up in estimating the following four equations for men and women separately and for the pooled sample. The last two equations (equation 18 and 19) will specifically estimate the returns to different controlling variables. Equation 16 and 17 show the simple Mincerian earning functions for the two definition of education.

Set A when family background is not controlled.

$$\ln W = \beta_0 + \beta_1 YEARED + \beta_2 \mathrm{K} + \beta_3 \mathrm{K}^2 + E_i \quad \text{.....(16)}$$

$$\ln W = \alpha_0 + \alpha_1 PRED + \alpha_2 SECED + \alpha_3 HIGHED + \beta_1 \mathrm{K} + \beta_2 \mathrm{K}^2 + \mathrm{N}_i \quad \text{.....(17)}$$

Set B when family background is accounted for all and the above three equations will be estimated but in all of them the following variables will be included

$$\ln W = equtio n16 + \beta_4 PATED + \beta_5 MATED + \beta_i \mathrm{Z}_i + E_i \quad \text{.....(18)}$$

$$\ln W = Equation17 + \alpha_7 PATED + \alpha_8 MATED + \alpha_i \mathrm{Z}_i + \mu_i \quad \text{.....(19)}$$

where, YEARED = Years of education attended

PRED	=	No. of primary schools years completed
SECED	=	No. of secondary school years completed
HIGHED	=	No. of years of higher education completed
K	=	Experience in years
PATED	=	Paternal education
MATED	=	Maternal education
Z_i	=	other influencing factor
E_i, U_i, N_i	=	Error terms

Some of the weaknesses indicated in the previous section clearly show that there are econometric problems faced in estimating the returns to education. These problems are related to the choice individuals make between working for wage or not and between working in the private sector or in the public sector. These problems are called the selectivity problem. There may also be endogeneity problems in of some of the variables.

In the first case, individuals choose between working in the labour market or in non-market activities. This problem is more severe for women because working in the labour market could negatively affect their reproductive and communal roles. Furthermore, all educated people may not get the chance of being employed in the labour market. When they are employed, all labour market participants may not end up in wage employment. Theoretically it could be rational to include double selection mechanisms. First selection for being employed and unemployed and second selection for being in the wage employment or in the non-wage employment sector. But this will come up with estimation problems that may not easily be solved. Furthermore, all educated people may not get the chance of being employed in the labour market. This problem is tackled by using a profit/logit function. It is only sufficient to have one latent variable that indicates whether a person is employed or not and explain it by several independent factors that influence this decision. Using the Heckit model one can then control for selectivity and arrive at an unbiased estimator. The magic, here, is simply to include the inverse Mill's ratio estimated from the probit/logit function into the wage function.

The estimation of these two-step procedures requires the probit and the wage equations to be identified. The procedure requires the participation equation to have at least one significant variable excluded in the wage equation. In this exercise variables which are believed to influence the probability of participating in the wage employment but not the wage rate are

identified and excluded from the wage equation. Unearned income in the form of remittance and number of elderly living in the household are categorised under this group and help identification. Maternal and paternal occupation by acting as role model is believed to influence more participation decision than wages. Thus, the probit equation is identified by these four variables.

In the second case, it is again essential to have a latent variable, taking one in the preferred sector or zero otherwise, and explain it by independent variables. The only difference here is that we do not use the inverse-mill's ratio to control for selectivity. What we should use here is a switching regression model that will endogenize the choice between sectors. This paper will deal with the first correction mechanisms to come up with possible unbiased estimators.

The final problem is related to assuming education and experience as exogenous. Individuals could decide their length of stay at school and employment tenure in a firm based on expected incomes; and these variables may end up being endogenous to the system. Inclusion of these variables in the model produces biased estimates (Gujirati,198:563). In such instances the use of instrumental variable method is recommended. But it is usually difficult to find appropriate instruments. "Nakura and Walker notes that if auxiliary instrumental regressions are weak, much of the original information may be lost."(Appleton and et al, 1995:9). Appleton and et al suggested that in such cases dropping the variable may create more serious problem in the form of omitted variable bias and they preferred to keep the variable instead. Following this argument education is assumed exogenous and no instrumental variable is used for it. On the other hand, potential experience (age - 6 - years of education) is used as an instrument for actual experience.

2.4. Data Description

As stated in the outset, the data for this study come from the Ethiopian urban socio-economic survey conducted by the Department of Economics of Addis Ababa University and University of Gotemborg. These two departments have so far conducted three rounds of surveys: November 1994, 1995 and March 1997. In this study we will use the first round conducted in November 1994.

The survey covers 1,500 randomly selected households that have 9191 members within them; of which 4,255 are males and the remaining 4,936 are females. The theme of this study is the returns to investment in education and consequently samples who are not active participants in the labour market (those who are non-economically active) are excluded in the analysis. The exercise has resulted in a total of 5527 sample population.

The data set provides detailed information on household demographics, migration, employment and income, and health. It does not, however, contain information on behavioural aspects like ability, motivation, doggedness, determination, etc., which could have influences on one's success in the labour market. Because of this, it is not possible to incorporate such factors in the analysis. This is also one of the weaknesses of this study.

In addition, some of the variables that this paper wants to incorporate, like business income and female business income, have limited observations and do not permit for regression analysis. Consequently, they are excluded from the analysis. Furthermore, the sample population itself is not large enough to extract enough observations on two or more labour market participants in a given household. For example, more than 53% of the sample population are sons and daughters of the household head and only few of them are currently employed. Had it been possible to extract such a data, fixed - effect method of estimation, which would control the effect of unobserved family and community characteristics, would have been used. Unfortunately the resulting data set is not sufficient for such analysis. The paper will, however, address the effect of family background through available proxies.

Given these covets about the problem of the data, the definition of variables and issues related to their measurement and descriptive statistics of important variables is presented below.

2.4.1. Definition of Variables and Measurement Issues

The variables that are used in the study can be grouped into three major categories: human capital, demographic characteristics, and family and firm specific environments.

Wage is determined by several variables. The main ones include initial endowments (which are fixed) and several dimensions of human capital (which are formed jointly by family and individual private inputs of time and goods, and by public inputs and services) and post schooling experience. If all the required information were available, human capital formations could be measured in five forms: net childhood nutritional status, schooling, migration, capacity to avoid unwanted fertility and adult's current health and nutritional status (Schultz, 1997 : 147-148). Often these variables are not found comprehensively in any household survey and proxy measures will be used for some of them and some others like net childhood nutritional status and the capacity of preventing unwanted pregnancy are excluded. Of all the empirical studies conducted so far a more comprehensive account of human capital variables was made by Thomas and Straus (1997). They controlled three types of health

indicators together with educational and other measures. In this study at least three types of human capital formations will be controlled for: education, health and migration.

Education is defined and measured in two forms. First, to measure education in its continuous form, the highest level of schooling an individual attained has been converted into years of schooling. This continuous years of schooling variable has also been disaggregated into primary, secondary and higher education to make sure that they measure the returns at different levels. It should be noted, here, that there are two important issues that need to be discussed. Because there is no complete data for all the sample population, it is assumed that:

- never has any schooling has stayed zero years in school.
- samples with religious and cultural education are considered as completed one year of education.
- samples with adult literacy certificates are considered as completed two years of primary education.
- Primary incomplete sample population has stayed the average school grade in the level - 3 years.
- college drop-outs have stayed two years higher education.

Another problem associated with the conversion is that of grade-repetition is not considered. This exclusion could inflate the efficiency of students and returns to education. Since there is no information on flow rates of students, the only choice available is to live with this problem.

In broad terms net childhood nutritional status, the capacity to avoid unwanted fertility and adult's current health and nutritional status can be classified as health indicators. Health status can be measured using different indicators: clinical measures of bodily attributes; anthropometric measures of height, weight, etc.; respondent - reported disease symptoms and illnesses; and reports on incapacity to undertake normal respondent activities (Behrman and Deolalikar, 1988:650). Due to collection costs, clinical measures have rarely been used in empirical studies. Respondent self-reported measurements are more common than others for their lower collection costs. Respondents can rarely measure such indicators accurately and if used in empirical studies they are prone to both random and systematic reporting errors (Thomas and Straus, 1997: 163). Incapacity for undertaking normal activities is rather crude measure of status of health. Hence, the preferred and the one which many researchers use is anthropometric measures but still they are relatively rare due to their collection costs (Behrman and Doelalikar, 1988: 650). Most health status indicators are prone to

measurement errors, but the errors and subjective valuation are less in clinical readings and anthropometric measures.

The most common anthropometric measures that are used for measuring health status are height, BMI (Body Mass Index) which is weight-for-height squared, and weight. BMI affects the current productivity of the individual, particularly at low levels of calories and for energy demanding tasks (Schultz, 1997: 148). Height at fourth birth day is a good predictor of an individual final adult height and adult height is an important determinant of adult productivity. It is inversely correlated with chronic health problems. Height is also inversely related to mortality and consequently length of productive life (Shultz, 1997: 147). "Foster and Rosenzweig (1992, 1994) point out that there may be economic reasons for the labour market rewards to vary with health measures in the event that productivity is not costlessly observable, because some health measures are more readily observed (such as BMI) by an employer than others (Thomas and Straus, 1997: 165). Given all the above issues related to measuring health status, this paper will use height as longterm and BMI as short term measures of health status.

Job search is the third type of human capital. People migrate in search of better economic opportunities. Migration often occurs in the first few years after completing school. The return to education for a rural-born person is most likely realised through migration. Since families sometimes move together as a unit, economic opportunities may not be the main causes for migration for women as for men. The effect of migration on earnings of individuals is controlled by a dummy variable. The effect of migration on access to employment will also be controlled.

Experience acquired after completing formal education are expected to increase labour productivity. Employers are ready to pay more to experienced workers than less experienced ones. When there is no information on - the - job - training, experience is taken as a proxy for such training. Actual experience may be endogenous to the system. Potential experience is used as an instrument for actual experience in the analysis.

Family background has an important impact on earnings of children and could influence the returns to any type of human capital formation. The family environment is to be proxied by parental education in this study. When parents are educated, they invest more on their children and create an enabling environment for study at home. Both maternal and paternal education will be used in the analysis. Maternal and paternal occupation is also used to control the effect of family background on access to employment.

Return to human capital is also influenced by the nature and size of employer and by the type of occupation that an individual is engaged in. The sector at which an individual is employed is likely to have its impact on earnings. Attempt is made here to control for such factors. The definitions of the main variables used in this paper are presented in Table 8 below. Occupations are categorised in to four groups. Unskilled occupation is defined to include sales, production, domestic, religious works, labourer and carpentery. Semiskilled occupations include clerical and supervisory works, technicians and equipment maintenance. The last two groups, professional and technical, and administrative\managerial occupations, follow their conventional definitions.

Table 8
Definition of Variables

Variables	Definition
PRED	No. of primary grades completed. If schooling greater than primary, PRED = 6.
SECED	No. of secondary school grades completed. If schooling is greater than secondary, SECED = 6.
HIGHED	No. of years completed in higher learning institutes. If more than 4 years, HIGHED = 4.
EXPP	Potential experience (Age - 6 - years of education).
YEARED	Total number of years that an individual remains in the school system.
PATED	No. of years the father stays in the school (paternal education).
MATED	No. of years the mother stays in school (maternal education).
EARM	Monthly labour income (both main activity & secondary).
MIG	1 if the individual (household) migrates, 0 otherwise.
YEARMIG	Years since migration.
EXPA	Actual experience (1994 - first employment date).
EXPF	Firm level experience (1994 - year first employed in the firm).
MRTSTAT	1 if the individual is married, 0 otherwise.
EMPSTAT	1 if the individual in the labour force, 0 otherwise.
Height	Height of an individual in cm.
Weight	Weight of an individual in kg.
BMI	Body mass index = Weight (kg)/Height $(m)^2$.
OCCCAT	Occupational Category .
FIRMSIZE	The size of the firm an individual is employed.
REMIT	Remittance Birr per annum.
NOELDER	No. of elderly in the household
PARTOCCU	Partner's occupations

2.4.2. Descriptive Statistics

The urban household survey has been conducted for three rounds so far. It collected information on 9191 individuals residing in seven major towns/cities in Ethiopia: Addis Ababa, Diredawa, Bahir Dar, Dessie, Jimma, Awassa and Mekele. Out of these individuals, those who are out of the category of economically active population (i.e., <14 and >65 years of age) are excluded. A total labour force of 5527 sample population were categorised as a potential member of the labour force. The distribution of labour force across towns/cities is given in Table 9.

Table 9

The Distribution of Potential Labour Force across Towns/Cities

City/Town	Count	Percentage
Addis Ababa	3637	65.8
Awassa	280	5.1
Bahir Dar	330	6.0
Dessie	289	5.2
Dire Dawa	425	7.7
Jimma	317	5.7
Mekele	249	4.5

Source: own generated table

As can be seen from Table 9, the majority of the potential labour force is from Addis Ababa which is about 66 percent of the potential labour force covered by the survey. The far second is Dire Dawa with 7.7 percent. When one looks into the gender decomposition of this potential labour force, 55 per cent are females and the remaining 45% are males.

The demographic characteristics of this labour force show that the majority of the sample population is sons and daughters of the head of the family. Only 16.3% are household heads and 9.7% their partners. 53.8 percent are sons and daughters. This tells us even though sons and daughters join the labour force, most of them do not form their own families but rather live with their parents. This may be due to several factors. One of the possible reasons, as can be seen from the data, is their inability to get suitable employment opportunity in the area. The data shows that 20 % of the sample population is unemployed and is looking for work. Another 22 percent are unemployed for different reasons and are not looking for work. Even those who obtain employment may not be able to finance their expenditures if they leave their parents. So many of them live with their parents.

Out of the total labour force, 32 percent are married. If one is to include those who are widowed, separated, divorced, the figure for being once married rise to 55.8 %. The ethnic composition of the sample labour force shows that Amhara's constitute 51.9 %, Oromos 17 %, Tigreans 9.8% and the remaining Nations and Nationalities constituted the 21.3 %.

It is essential to see the distribution of the labour force across different employment categories. 16 percent of the labour force are employed in the wage employment sector. About 30 percent are working as employers, own account workers, female business, unpaid family workers or as housewives. The remaining is unemployed. The figures are transparent and speak for themselves. Urban areas are struggling with a huge number of unemployed people: and the wage sector of the economy has low capacity and the majority of the labour force has to engage itself in the informal sector. Since the analysis of this paper mainly bases itself on the wage employment sector, one has to question estimated results that do not account the selectivity bias that could be introduced if the analysis is to focus only on those employed in this sector. Estimates based on firm specific samples may not be accurate and may also be misleading.

Given this general description of the labour force, it is now proper to go into the descriptive statistics of variables that are of interest. In so doing, the mean is presented and discussed for continuous variables. The frequency distribution of dummy variables is also presented as it is more appropriate for such variables.

Socio-economic statistics usually reveals the existence of earning discrepancy among groups. For example, average female wages are lower than males. In this sample, the same feature is observed. Average earning is about Birr 593. But there is a gender gap between males and females. While the average monthly labour income for males is Birr 682, the figure for females is only Birr 462. This has given rise to a gender parity index of about 48%.

Various reasons exist as to why women earn less in their labour incomes. The most important and often cited reasons include differences in human capital formation, and differences in sector and occupation of employment between men and women. It is often argued that women have skills that are readily transferable to services and sales works which are less paying. Labour market segmentation is also cited as a possible cause for labour income inequality. It is, therefore, in order to look into some of the descriptive statistics on human capital formation, gender and occupational distribution if they provide a clue on the existence differences in gender returns to schooling and labour market discrimination.

Women do not only earn monthly wage less than male counterparts. But their achievement in human capital formation is also lagging behind. In education, for example, 94 percent of the sample male population has either attended or is attending school. About 20% of female samples, however, have never attended schooling. This shows that there is a gender gap in obtaining educational opportunities.

There are several factors that influence school enrolments in Ethiopia. Some scholars have attempted to provide empirical results on this issue. Anbessu and Jung (1988) found out that only 10% of school age children have enrolled in schools and that the traditional practice of early marriage contributed to school dropouts in and around Bahirdar. They found out that 15% of boys and 18% of girls were promised for marriage, married or divorced by grade 2 and the figure progressively increases to one third for girls by grade 6. Esmode (1991) also confirmed this fact. His study in Dalocha Wereda found out that parents resist sending their children of either sex for arranged marriages may be compromised. The USAID (1993) report, however, provides a different reason. It ascribes the major reasons to be economic (Mulat Demeke, 1997: 2-3).

In the survey used for this study, respondents were asked to answer why they do not attend schooling. Their response shows that the main reason is not of cultural practices but of economic ones. 63 percent of females and 65 per cent of males responded either they are needed at home, can not afford schooling or education is not paying. 16 per cent of females remain out of school for the school is too far. The respective figure for males is about 11 per cent. See Table 10 for the details.

Table 10

Reasons for Not Attending School, Sample Population, 1994, in Percent

No.	Reasons for not attending	Male	Female
1	Help needed at home	28.1	35.3
2	Cannot afford school expenses	22.4	15.8
3	Because of bad health	7.5	7.8
4	School is too far	11.4	16.0
5	Education is not paying	14.2	12.5
6	Lack of awareness about education	7.1	5.9
7	Religious cultural reasons	1.4	1.4
8	School not available in the area	2.1	1.4
9	Early marriage		0.1
10	Other		
	Total Count	279	855

source: own generated table

Disparity in access to schooling is one thing. But effectively remaining in school is another. After enrolling into the school system more often than not females do stay short periods in the school system. On the average, males stay for 6.83 years in schooling while females learn for 5.54 years. The situation remains the same if we look into the picture in primary and secondary schooling. While men remain for 3.2 years at primary schools, the figure for females is 2.7 years. Once at secondary schools, men on the average are bound to complete junior level of schooling before leaving the school system. But females do not even complete the first year of secondary education.

The situation will even be clearer if we look at the percentage distribution of sampled male and female populations' educational achievement.

Table 11
Education Achievement in Years of Education in Percent Sample Population, 1994.

No.	Years of Education	Male	Female
1	0	11.2	20.5
2	3	28.9	30.8
3	6	7.5	7.7
4	7	7.0	6.3
5	8	8.1	6.9
6	9	5.1	4.2
7	10	5.3	4.8
8	11	3.7	3.0
9	12	16.9	12.9
10	14	4	2.4
11	16	1.9	0.5
12	18	0.5	0

source: own generated table

As can be seen from Table 11 the proportion of females who attain a given level of education is lower than the proportion of men at all grades of education. Their proportion is higher at lower levels of education and lower at higher levels of education.

The opportunity cost of girl's education is higher than boy's education (MOF, 1996: 16). Females often are called upon to support their mothers in domestic chores. Because of this, they do have little spare time after school for their studies. This has created more repetition in grades which in general has an effect of reducing the incentives for girls to stay more years in schools and financing the education of girls by parents. Consequently, girls do drop out more from the school system.

No significant difference exists on the distribution of the educated sample population between private and public sectors, particularly in primary and secondary education.[1] The public sector has a slight advantage in employing people with higher education. Another visible difference observed is that public sector hires people with more firm specific experience and less non-firm specific experience while the opposite is true for the private sector. This may be due to the fact that public sector employs people directly from schools and once people are employed in the public sector, they are less likely to leave and move between jobs.

[1] Public sector is defined to include civil service workers, public enterprise employees and international organizational employees. Private sector on the other hand is assumed to include private sector employees, service/producers coop employees and members, casual workers and daily labourers.

Given the above general description of the educational attainment of the sample population and earnings of males and females, the data seem to suggest that there exist different incentive structures for men and women. But this conclusion needs to be seen in relation to the situation of other human capital variables.

Out of the total labour force, nearly 10% of the sample population obtain some kind of remittance. The average level of cash remittance received per year amounts to Birr 81 and 6% of the total labour force migrated in search of better job opportunities.

The means of continuous variables are presented in Table 12 and 13 disaggregated by sex and sector. These tables clearly show that men do have advantage over women in all other variables except for potential experience, nonfirm specific experience, and educational attributes of parents. This reflects that men have better personal characteristics that need to be rewarded accordingly.

Table 12
Mean of Basic Variables by Sex

	Male	Female
EARH	0.25	0.22
EXPF	1.56	1.35
EXPNF	0.81	0.92
HIGHED	0.24	0.10
PRED	5.1	4.01
SECED	3.27	2.23
YEARED	8.65	6.35
AGE	30.8	30.20
EXPA	4.03	3.89
EXPP	14.92	15.92
HEIGHT	141.38	149.25
MATED	0.29	0.37
NOELDER	0.26	0.33
PATED	1.37	1.47
REMIT	86.21	76.18
YEAR MIG	1.24	1.19

source: own generated table

The above descriptive statistics demonstrate that men earn more than females. It also shows that men are better endowed with productivity enhancing attributes. One needs therefore to go beyond the descriptive and look into returns to education by gender and see whether the

labour market explains the lower educational achievement of females. This is the exercise in the next section.

Table 13
Mean of Basic Variables by Sector of Employment

	Self Employed	Private	Public
EARH	11.88	1.0	1.72
EXPF	8.63	5.67	11.62
EXPNF	1.0	6.00	5.08
HIGHED	0.75	0.14	0.15
PRED	4.0	4.54	4.51
SECED	3.75	2.63	2.63
YEARED	8.5	7.33	7.29
AGE	28.38	30.48	29.87
EXPA	5.0	13.06	12.54
EXPP	6.88	15.63	14.28
HEIGHT	151.88	134.28	137.73
MATED	3.5	0.25	0.36
NOELDER	0.13	0.32	0.25
PATED	2.38	1.15	1.20
REMIT	282	424	310.7
YEAR MIG	5.5	5.05	5.56

Source : own generated table

2.5. Estimated Results

2.5.1. Some Introductory Notes

Before presenting estimated results and inferences, it is important to once again review the problem of data and estimation. The problem of data and their implications on estimated results will be highlighted first. The econometric problems encountered and how they are dealt with will then be elaborated. With these covets explained, the estimated results and inferences will be presented.

As has been pointed out throughout this paper, the data set has several limitations. It has no information on behavioural factors; there are many missing cases which reduce flexibility; because it does not contain sufficiently large number of households, it is not possible to

estimate fixed-effects model applied by Behrman and Doelalikar (1993).In addition, the earning information is not reliable.

For instance, the data set contains individuals who are employed either in the civil service or public enterprises with an educational level of the first degree or diploma whose salary is below the minimum entrance level. So educated individuals have become unemployed since the central placement was abandoned. But once they are employed in the civil service or public enterprises, they are guaranteed to get the minimum salary set for civil service. The information contained in the data set is, however, contaminated with errors related to data collection and/or recording. There are cases that illiterate people working in the civil service earning a monthly income of Birr 2000 and above. There are also cases where an under age children earn a labour income unimaginable by Ethiopian standards. These problems are likely to bias the estimated results. Since in most of the cases, the earnings of educated people are misreported, it is likely that the estimated rate of return to be underestimated.

In order to go around the problem, attempt is made to adjust the data. Initially, outliers and working underage children are excluded. Assuming that the reported educational level and sector of employment are correctly reported and recorded, for those with diploma and first degree level education and working in the civil service and public enterprises, the earnings of these labour force is adjusted to the minimum entrance salary level.

In building the model, first the assumptions of classical regression analysis are checked. Diagnostic checks on the existence of outliers and influential points are conducted using studentized residuals and DFBETAs. Trimmed means are substituted for extreme points. Normality check is conducted through graphic plots and the variance- covariance matrix.

Once the data is checked for behaving normally, estimation and inferences are possible. As the data is a cross-section, it is natural that it may be faced with hetroscedastic errors. The existence of hetroscedasticity is bound to reduce the efficiency of OLS estimates though the parameters will remain unbiased and consistent. In the case of sample selection models, however, hetroscedasticity will make estimates biased and inconsistent. In order to avoid this problem, all the estimated parameters presented below are hetroscedasticity-corrected estimates.

The paper basically produces three different parameter estimates. First OLS results are presented. In such type of exercise, OLS is faced with sample selection bias because it excludes those samples that are not wage employees. The Heckman two-step procedure (the

Heckit model) is estimated to correct the problem. But Nawata and Nagassa (1996) argued that estimates from the Heckit model may not perform well when high degree of collinearity is observed between the explanatory variables and the hazard ratio (Nawata and Nagasa, 1996:389). They suggested the use of MLE estimators. Peter Kennedy, 1992, stated that Heckman's procedure is consistent but inefficient when compared with MLE estimation. He, however, upholds the view that the procedure can be used in censored data, as ours, but not for truncated data (Kennedy, 1992:). Consequently, to see their differences, both the ordinary Heckit and maximum likelihood two-step procedure estimators are reported.

The analysis of gender differential in returns to education is not limited to the descriptive gender parity index. Existence of such differentials is established or rejected using statistical methods. The Chow and Wald tests are used for OLS and Heckit, and MLE two-step procedure respectively.

There are, however, econometric problems that are still outstanding. Although attempt is made to include all relevant variables as the data set allows to do so, there are still omitted variables, some are known (e.g. ability and behavioural factors) and some others are not. These factors could create some bias in the reported results. Given the above covets, the estimated results on returns to education is given below.

2.5.3. Returns to Education

Given all the limitations of the data, the return to education is estimated using three estimating methods: OLS, ordinary Heckman's two-step procedure and MLE two-step procedure. Education is defined in two forms: as one year additional education and years spent at different levels of education. In all the three methods and two definition of education, two separate earning functions are estimated, with and without controlling the effect of other factors like family background, job characteristics and demographic factors. Estimates are presented on case by case basis by starting from the definition of additional year of schooling.

When education is defined as a continuous variable in the form of YEARED, a year of additional schooling, the three methods provide different but comparable results. Leaving aside the influence of other factors, the return to education is the lowest when OLS is used. The return to one year of additional schooling is not greater than 6 percent. Although the estimate is significant at conventional levels, the rate is not as high as one would expect it to be and when compared even with other alternatives. Given that there is collecting or

recording problem in the data, this shortcoming could contribute its share for such small returns.

The MLE estimators provide somewhat meaningful estimates. According to the Heckit model, the marginal return to education for one additional year of schooling without controlling other factors is 6.4 percent. The respective figure for MLE estimators is 10.1 percent. The extracted estimated rates of return are presented in Table 14.

Table 14
Rate of Return to One Year of Additional Education in Percent by Method of Estimation.

No.	Method of Estimation	Rate of Return in %
1	When other influencing factors are not controlled	
	OLS	6.1
	Marginal effects of Heckit model	6.4
	MLE	10.1
2	When influencing factors are controlled	
	OLS	6.0
	Marginal effects of Heckit model	6.4
	MLE	10.5

* The return to one year of additional schooling is significant at conventional levels.

** All estimates are hetroscedestic robust estimates.

*** Influencing factors included into the regression equation are potential experiences, its square, martial status, maternal and paternal education, health indicators (BMI and height), occupational category, firm size, remittance. See Annex table A1 to A18 for detailed estimated results.

The return to education per each additional year is a rough guide for decisions on educational demand. This is because for one thing each additional year could not have equal returns for the human capital as the quality and level of knowledge differs among different levels of education; for another, people usually do not demand education on year by year basis but use different educational tiers (primary, secondary, firs degree, etc.,) which act as a braking point for decision making. The returns to different levels of education provide, therefore, a clearer signal on how much education one has to invest to obtain the maximum benefit possible. Hence, it is essential to look into the returns to different levels of education.

Table 15

Returns to education to different levels of education

	Rate of Return at		
	Primary	Secondary	Higher
1. When other factors are not controlled			
• OLS	3.0*	4.5	41.7
	(1.3)	(2.9)	(6.75)
• Sample Selection (Heckit)	3.1*	4.9	41.2
	(1.72)	(2.24)	(6.68)
• Sample Selection (MLE)	4.2*	10.4	33.2
	(1.44)	(4.26)	(4.04)
2. When other factors are accounted for			
• OLS	2.3*	5.5	39.3
	(1.10)	(3.0)	(7.2)
• Sample Selection (Heckit)	2.5*	5.8	40.4
	(1.205)	(3.1)	7.3
• Sample Selection (MLE)	5.0*	10.6	31.0
	(1.76)	(4.47)	(4.66)

Figures in parenthesis are t-ratios.

* significant at 10 %

As can be seen from Table 15, the return to primary education is not significant at conventional levels for the pooled sample. This implies that given our sample, primary education does not have meaningful returns on its own. On the other hand, the returns to secondary and higher level education is comparable to returns to other forms of capital if we take the discount rate to represent returns to other forms of capital.

From both Table 14 and 15, two common trends emerged. First, the return to education increases as the level of education increases. Primary education has no significant returns at 1 and 5 percent significant level. Even if it is significant, the estimated return is much lower than both post-primary education levels. The return to secondary education on its part is much lower than the returns to higher education. This finding does not confirm with many findings other studies and has an important implication on policy making in Ethiopia, which will be examined later. Second, the estimated rate of return for primary and secondary

education has improved as one goes from OLS estimation procedure to Heckit model and again to MLE sample selection model. Estimates from OLS and simple sample selection models are starting point results and will improve as one uses MLE sample selection.

Before we select one estimator as a reliable estimate, it is necessary to note the weakness and strength of each method. The OLS excludes those not reporting wage employment, yet part of the potential labour force, and include only wage earners. In this sample only 16 percent are in the formal wage employment sector. "The decision to join the labour market influences wages because the characteristics that affect labour market participation may also interact with wages" (Kandker, 1990:13). Thus, there is a need for the OLS estimates to be independent of these characteristics. The Heckit model provides the way out. After controlling the effect of characteristics determining participation in the probit equation, Heckman's two-step procedure uses OLS in the wage function. Since unobserved characteristics could affect both labour market participation and the wages rates (i.e., the correlation between the wage rate and participation error is not zero), the Heckit model provides consistent but not efficient estimators (Kandker, 1990:13). A maximum likelihood method takes account of the correlated error and yield consistent and efficient estimates. Therefore, the estimates produced by maximum likelihood estimation are preferred to the other two alternatives.

Another important fact that emerging out of this exercise is that estimates of return calculation need to incorporate as much influencing factors as possible in order to come-up with unbiased estimator. The above tables show that the inclusion of relevant variables has corrected the bias, be it up wards or downwards.

A comparison of OLS and sample selection models results suggests that the estimate of private return to education, be it additional year or different levels of education, are sensitive to sample selection correction. The estimated rates of return increase for primary and secondary education when sample selection is introduced. The estimates for higher education, however, declined as a consequence of such an exercise.

The above findings have important implications. First, the traditional wisdom that has been the cornerstone of educational policy making is not supported by the evidence produced here. Psacharopoulos's results, for example,show that the average private returns to primary ,secondary and higher education for developing countries to be 29,19 and 24 % respectively (see table 4). All methods of estimation have found out that primary education to has private the lowest returns. The belief that primary education provides the highest return not only to the society but also to the individual has been the cornerstone for adopting policies for

expanding primary education. As long as primary education is not paying for an individual, the demand for education may be difficult to come by even if educational services are expanded. This evidence is supported by other studies. Hoddenott and et al., and Bennett, have come up with similar evidences in Africa. This does not, however, imply that investment should altogether be curtailed for this level. Such low level returns to this level may be a result of low quality of education at that level and/or the mismatch between education and work conditions. If these reasons hold, the implication of this study is that it may be necessary to shift investment in primary education from mere expansion to improvement in quality and development of appropriate curriculum.

Second, the rate of return to higher education is found to be commensurate enough in all the three estimation methods. If we assume that the estimated rate of return is going to be stable for sometime in the future, individuals could be willing to cover some of the direct cost of higher education by using different forms of cost-sharing arrangements. The finding suggests that as long as there is significantly higher private economic incentives, the individual will be motivated to cover some of the educational costs associated with his/her schooling. In this regard, the policy of the government to introduce some kind of cost recovery at higher education levels is justified by evidence obtained from this exercise.

2.5.4. Gender Differences in Returns to Schooling

As pointed out in the background, there is a huge gap between the enrolment of boys and girls in Ethiopia. The gender parity index in enrolment to schooling ranged from 0.56 to 0.7 percent between the years 1992/93 and 1995/96. If parents make rational economic decision on educating their children, then, the private economic return to education should reflect that females return should be lower than males in Ethiopia. The exercise in this section is devoted to this issue. The core issue here is that unfair hiring practices or lower remuneration of women for equally productive attributes may create a wedge between men's and women's returns to education. If the problem of the wedge is on the demand side, the following analysis will corroborate the fact.

The estimation and inferences on the existence of gender differential is made once again based on the two definitions of education and the three estimating methods. We will first examine the results for additional year of schooling.

We will first examine the results for additional year of schooling. A glance at the estimated results reveals that all the three methods seem to concur to the result that there exists gender differential in returns to schooling. In all cases, the returns to schooling for females are lower

than males. The returns to education for males is more than females by 70% for OLS and ordinary Hecht models; and more than 50 percent for the maximum likelihood two-step procedure when other factors are not controlled. This gender parity declined when other factors are accounted for. The maximum disparity is observed in the ordinary Hecht model, where the gender difference in returns to schooling is found to be about 40%. The disparity index is 17.2 and 13.2 per cent for the OLS and MLE two-step procedure.

Table 16

Gender Differences in Returns to One Year Additional Education by Method of Estimation

No.	Method of Estimation	Private Rate of Return to Education		Existence of Gender Differences in R.R.E.		
		Male	Female	GDI	Computed	Critical
1	When other factors are not controlled					
	OLS	8.1	4.7	0.7	1.93	2.37
	Marginal effects (Hecht)	8.5	4.9	0.73	4.139	2.37
	MLE	12.2	7.9	0.54	4.254	5.02
2.	When the influence of other factors are controlled					
	OLS*	7.7	5.4	0.17	7.547	1.67
	Marginal effects (Hecht)*	7.8	5.6	0.39	4.327	1.67
	MLE	11.1	9.8	0.13	0.468	5.02

*Significant gender differences.

- GDI is gender parity index calculated as {(Male - Female)/female} returns.
- The basic information from which these statistics are computed and presented from annex tables.

The gender-parity index is a simple description of the observable situation. The test for existence of gender difference in returns to schooling needs an exercise beyond that. It calls for the use of statistical methods that establish or reject the fact based on hypothesis testing. In this regard the Chow test is used for the OLS and ordinary two-step procedure.

Although all of the gender-parity index has found out that there is gender differential in returns to schooling and always the men's being higher than the female's, these statistical tests provide a seemingly mixed conclusion. The Chow test on OLS and ordinary Heckman model supports the view that men, on the average obtain higher returns from their investment on each additional year than females. This implies again that families are rational to invest more on their sons as against their daughters. This conclusion, however, is rejected by the Wald test applied on MLE estimates. The Wald test established that there is no significant gender differencein returns to schooling between men and women. This implies that the

reason for lower returns to schooling should be found elsewhere. Labour market return to education does not explain enrolment differences. Clearer picture may emerge if we look into the issue by disaggregating education into primary, secondary and higher education.

Table 17

Gender Differences in Returns to Education by Alternative Estimation Methods and Level of Education

No.		Private Returns to Education							
		When factors not controlled				When factors accounted for			
		Primary	Secondary	Higher	Test	Primary	Secondary	Higher	Test
1	OLS				rejected				rejected
	Male	7.9	2.7	43.3		6.2	3.9	38.8	
		(1.83)*	(0.9)	(5.4)		(1.73)*	(1.5)**	(5.8)	
	Female	-	6.5	41.5		(-0.3)	7.7	44.3	
			(2.3)	(3.9)		(-0.13)***	(2.9)	(4.5)	
2	Ordinary Heckit Model				REJ.				rejected
	Male	8.0	2.9	44.2		6.4	4.2	40.4	
		(1.8)*	(0.907)	(5.425)		(1.814)*	(1.642)*	(6.025)	
	Female	-0.035	6.9	41.4		-0.32	8.2	44.2	
3	MLE two-step model				not rejected				not rejected
	Male	10.1	8.4	32.3		8.95	8.7	28.6	
		(2.338)	(2.7)	2.96		(2.2)	(3.1)	(3.864)	
	Female	0.37	11.3	36.9		1.9	12.1	38.4	
		(0.086)	(2.9)	(2.62)		(0.399)	(2.974)	(2.68)	

- all figures in parenthesis are t-ratios.
*Significant only at 10 percent.
**Significant only at 20 percent.
***Not significant at ll.

The empirical evidence produced in this regard show that all the three estimation methods and regardless of whether other factors are controlled or not the private economic return for female primary education is not found to be significant. This implies that own primary education is not paying for females. The return on male's education at primary level is greater than females and is significant in all cases on at least at 10 per cent significant level.

When we go higher in the educational echelon to secondary education, all estimation methods reveal that the returns to secondary education is higher for female than for males again regardless of whether other factors are controlled or not. In this case, the returns for females are all significant at conventional levels. When we assess on higher education the evidence seems mixed. When other influencing factors are not controlled the OLS and ordinary Heckit models show that private return to education is higher for males than for females. When these factors are accounted for, both these models show that the return to female education is higher than male's education. Results from the MLE two-step procedure indicate that the returns to female education to be superior to that of men. The statistical test on the preferred model does not, however, reject the equality of gender returns to education.

Since the parameter estimates are unbiased when more influencing factors are included, the estimates using the extended model are preferable. The result of the extended model on gender differential is also supported by the more efficient maximum likelihood two-step procedure. Hence, the conclusion that comes out of this analysis is that returns to education for female's is at least equal to that of males at secondary and higher levels of education.

Overall a simple look into the estimated private returns show that education is not paying for females at primary level, but once they completed primary education and go to higher levels in the educational echelon, they can equally benefit from educational investment.

The enrolment figures in Ethiopia show that not only females do have lower enrolment ratios when compared to males but also their proportion declines as one goes higher in the education level. This is clearly inconsistent with what we found in this study. Had private economic return to education been the basis for enrolling children, other things remaining the same, we expect more girls at post-primary educational levels. But this is not reflected in the Ethiopian data. Thus, we can conclude that the labour market returns to education are not the reason for lower enrolment ratios for girls.

2.5.5. Returns to Other Factors

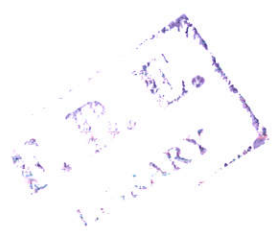
Education, as presented above, contributes significantly to earnings and investment in education pays for an individual. But education explains a small proportion of incomes. The above result shows that when other factors are not controlled, the OLS simple Mincerian equation explains only 13.1 %. This clearly reflects that the large share of the income differential is unexplained by education differential alone. Hence, the need to incorporate other relevant factors becomes necessary.

The exercise of including such factors has increased the explanatory power of the regression. The OLS estimates increased to 34 percent. The log likelihood function for the simple sample selection model increased from -1313.4 to -1182.2. The log likelihood function for the MLE has changed from -2644.3 to -2574.5 when these additional factors are included into the model.

The inclusion of factors into the model does not only increase the explanatory power of the regression, but also changed the estimated parameters. Often returns to education estimated without controlling other factors has been found overestimated.

All the above evidences show that if one does not account for different other relevant variables, the parameter estimates produced will be biased. Relevant variables need not required to have a significant effect on their own to be included in the model as long as the overall regression fits better.

In this exercise, different own, parental, and firm characteristics are accounted for. Potential experience, its square, father's and mother's occupation, maternal and paternal education, occupational category of an individual, firm specific and outside-firm work experience, migration, Body-Mass-Index (BMI), height, marital status, and the size of the firm are included into the model. BMI and height are to proxy health, and migration to job search. Different firms do employ different technologies, which ultimately affect the returns of labour. It is, therefore, assumed that though very rough, firm size could reflect some kind of variation in technology. The larger the size of the firm, the greater the opportunities for wage advancement. After including all the above variables, some are found to affect income significantly while others do not. Given the theories of wage determination, those that have no significant effects are still retained. The explanations presented below are limited only to those that have significant effects.



In all most all cases, whether we use OLS, simple sample selection or sample selection MLE, the significant variables are almost always the same. Those that have significant influence on earnings are maternal education, occupational category, firm specific experience and firm size.

Table 18

Estimated Returns to Different Background Factors Using Alternative Methods, Only for Significant Ones, Education = 1 Year Additional

	Method of Estimation		
	OLS	Sample Selection	
		Normal Heckit	MLE
MATED	1.16	3.8	4.5
	(2.18)	(2.77)	(2.1)
OCCCAT	4.85	31.1	27.45
	(2.296)	(11.32)	(8.1)
EXPF	-	29.2	1.9
	-	(7.62)	(4.6)
Firmsize	1.15	3.6	
	(1.838)	(4.0)	
MIG	-	-	20.6*
	-	-	(-1.81)
MRTST	-	-	32.5
			2.75

*Significant at 10 percent only.

-figures in parenthesis are t-ratios.

Table 19

The Returns to Different Background Factors, Only for Significant Ones, Education = Different Levels.

	Method of Estimation		
	OLS	Sample Selection	
		Normal Heckit	MLE
EXPP	-2.6		
	(-2.5)		
EXPF	2.7	2.9	1.9
	(7.4)	(7.72)	(4.6)
MATED	5.9	6.4	4.7
	(2.7)	(2.85)	(2.24)
Firmsize	3.6	3.7	1.0
	(4.2)	(4.22)	(1.53)**
OCCCAT	28.8	30.6	26.9
	(10.93)	11.4	(8.11)
MIG			18.3
			(1.698)*
MRTS			21.6*
			(1.82)

-figures in parenthesis are t-ratios.
*Significant only at 10 percent only.
**Significant only at 15 percent.

Table 18 and 19 clearly established that some of the personal, family or firm specific characteristics significantly affect earnings. All other forms of human capital variables (health as proxied by BMI and height; and job search as proxied by migration) do not have significant impact on earnings in this sample. The Ethiopian labour market seems to reward only educational investment in the form of higher wages and not other forms of human capital formation. The exception to this general conclusion is that migration becomes significant at 10 percent and has significant impact on earnings when one used the maximum likelihood sample selection model.

The other interesting finding in all cases is that although maternal and paternal education are included in the wage equation, paternal education has no impact on children's earnings. In contrast, maternal education has alway significant effect on children's earnings in the different estimation methods. The marginal effect of maternal education on children's earnings range from the minimum of 3.8 per cent to the maximum of 6.4 per cent. In addition, all other controlling variables (including those indicated in table 17 and 18 in this analysis) have no indirect effect; they do only have direct effects on earnings. Maternal

education has, however, an indirect effect when education is measured disaggregated by levels.

We can draw one obvious conclusion from the above findings. The impact of female education is not limited to own returns but transcend into the next generation. Hence, the evidence produced here supports the view that educating a male is educating an individual but educating a female is educating a family. If we take only own effect in comparing the returns to education between men and women, we are bound to understate the returns to women's education. Hence, evaluation of the returns to female education should always consider this transgenerational impact. Another conclusion that emerges from this fact is that if one does not account family background in the wage equation, in one form or another, he/she is likely to end up with biased estimates.

The other important variable that significantly determines earnings is the occupational category. In terms of marginal effects, it stands out uniquely higher than any variable including education. The effect of occupational category on earnings ranges from 27 percent to 31 per cent. The result could have been more meaningful had we estimated different earning functions for different occupations and compared the resulting parameter estimates. In that case, we would be able to tell the effect of all variables, including education on earnings of each category. Unfortunately, because of the limited data set, the exercise cannot be undertaken. Note should however be made that one of the major determinants of one's occupational category is the level and type of education he/she attains. So, although we can not identify the indirect effect, education is believed to have a significant share of the effect of occupational category.

Firm level experience has also contributed to earnings differential. The evidence generated in this sample illustrate that human capital formation in the form of accumulating job tenure in one firm is more paying than moving from job to job. Firms reward more for employees working already there than for those coming from outside. This can be explained by the fact that non firm-specific work experience is not rewarded in this sample.

The other important characteristics that need to be raised is the effect of firm size. Firm size is found to have from 1 to 3.7 per cent effect on earnings. As the firm size increases, the probability of labour turnover increases and there is chance for employees to be promoted from one job to another depending on their personal characteristics.

CHAPTER - 3

III. MALE-FEMALE WAGE GAP AND ITS DECOMPOSITION

The creation of human resources is one thing; their effective utilisation is another. It is important, therefore, that there exists the right environment and incentives to fully and productively utilise these resources. This, among others, calls for factor prices to reflect their economic scarcities. The failure of the market to secure such an outcome can result in economic inefficiency.

The traditional division of labour between men and women, which reflects partly biological fact of life and partly the domination of society by man, has its effect of limiting opportunities for women in the labour market and demarcating "acceptable" and "unacceptable" occupations for women. This has caused the relative earnings of women to lag behind men.

The descriptive statistics in the previous chapter, clearly show that there is male-female wage gap in the Ethiopian urban labour market. Women on the average earn 48 % less than their male counterparts. This much is known. What is not known are the factors that caused this wage gap.

Wage differential can be caused by many factors. It can be caused by heterogeneity of jobs. Jobs have different risks, fringe benefits, status, location, regularity of earnings, prospect of wage advancement and extent of control over the work place; each of which carries different wage premium that could create differences in earnings. It can also originate from heterogeneity of workers. People can accumulate different stocks of human capital and create different noncompeting groups which are not substitutable to each other. People could also have differing individual preferences, including being present - or future - oriented, that have impact on the interest rate to be used in discounting future costs and benefits. These together explain substantial wage differentials. The third and final source of wage differential is heterogeneity of employers. The status of union, the firm size, recruitment and retention strategies and of course the tendency of employers to discriminate against certain groups contribute greatly to observed earning differentials (McConnell and Brue, 1986: 328-336).

It is hardly possible to measure and present the contribution of each of the above sources of wage differential in earning inequalities in Ethiopia. That needs extensive data set and more time. This exercise is hoped to shed some light on whether employers discrimination contribute significantly to earning differential between men and women in urban Ethiopia. In

so doing, attempt is made to control the effect of heterogeneity of jobs and workers on earning differentials between males and females.

This chapter attempts to analyse the issue. The first section presents the theoretical arguments. The second section will review and document the empirical literature in other developing countries and those available in Ethiopia. Section three describes the model to be used and finally section four presents the estimated results.

3.1. Theoretical Background

The analysis of wage differential emanates from the theory of discrimination. Economic discrimination "exists when female or minority groups, who have the same abilities, education, training and experience as others are accorded inferior treatment with respect to hiring, occupation access, promotion or wage rate" (McConnel and Brue, 1986 : 290). The authors also identified four types of discrimination: wage, employment, occupation or job and human capital discrimination. The first three types of discrimination are usually referred to as post-market discrimination while the last one is referred to as the pre-market discrimination. As the focus of this study is wage discrimination, the focus of what follows will be limited to post-market discrimination.

Because the interest among economists in discrimination is of a recent phenomenon; discrimination assumes different guises and different forms for different groups; and the roots of discrimination are diverse and complex, there is no generally accepted theory of discrimination. But there are important and often cited theories or models of discrimination. These include Becker's taste-for-discrimination, the monopsony, the overcrowding, the statistical and the human capital models.

The empirical evidence on male-female wage differential was established long before the theory of discrimination has been formulated. This was made possible by using statistical descriptive. The theory of labour market discrimination was first forwarded by Becker (1957).

According to Becker, males and females are equally productive and deserve equal payments in the absence of discrimination. But he argued that employers, co-workers and customers have taste for discrimination which requires compensation for employing or working with them. This calls for a wage discount for women to compensate the disutility they created for employers, co-workers and customers. His theory is criticised for many reasons. One of these is that given that the tastes for discrimination vary across employers, the least

discriminatory employer will employ more women and as a result of competition, only these firms will survive (Blau, 1984: 121). This problem has created scepticism among economists and they fear whether indeed labour market discrimination as postulated by this theory explains the existing wage gap.

Bergmann (1974) gave a more central role to employment segregation and developed his "overcrowding" model. According to this model, segregation plays a causal role in producing discriminatory pay differentials. As a result of segregation and overcrowding, women have less access to capital to work with and consequently they are less productive than men. This results in both pay and productivity differential (Blau, 1984 : 121).

The third discrimination theory is the monopsony theory of discrimination developed by Madden (1973). Madden developed Robinson's (1933) monopsony model to explain wage differential between men and women. This theory based its argument on the presumption that females and males have different labour supply curves. According to this model, females have a supply curve lower than males and as a result the wage sensitivity of labour supply is low. A price discriminatory monopsonist will take this to his advantage and pay women a wage rate lower than men. But it is argued that there are several reasons (including occupational segregation, power of male unions, less job search by women) that could explain the lower elasticity women's labour to changes in wages. The evidence produced by Blau and Jusenius (1976) showed that aggregate female labour supply is more elastic than men labour supply. The above counter arguments questioned the relevance of monopsonist discrimination model to explain existing wage differentials.

Another approach that tried to explain long run existence of discrimination is the statistical discrimination model developed by Pelp (1972), Arrow (1972) and Aiguer and Cain (1977). The basic rationale behind this model is that employers have imperfect information on actual productivity of employees and may discriminate women because of real or perceived productivity - related behavioural differences. If the perceived is being realised, then there will be no discrimination. But most often there will be divergence between what is perceived and actualised and this may create discrimination. This model is criticised for not judging the individual on his own right but on group basis.

The model that seems to be relevant to explain the existing wage gap between men and women is the human capital model developed by Mincer and Polachek. Given the traditional division of labour, according to this model, women expect short and discontinuous involvement in the labour market, which reduces the long run payoff to their human capital

investments. At the same time employers are reluctant to invest on firm specific on-job-training. These together may make the earnings of women to be lower than men.

Which of the theoretical formulations is correct can be debatable. There is, however, a consensus that there is labour market discrimination in many countries. The existence of such discrimination acts as a means to transfer income from women to men and entrepreneurs. This transfer of income was formally developed by Arrow. He showed that men and entrepreneurs would earn a wage and profit rate, which is above the normal one when there is discrimination. Women on the other hand may earn a wage rate below the non-discriminatory one. Arrow developed the neo-classical profit function and showed that

$$E_M = MRP_M + dM \quad \text{.....(20)}$$

$$E_W = MRP_W - dW \quad \text{.....(21)}$$

$$\Pi = QR - M(MRP_M) - W(MRP_W) + Wd_W - Md_M$$

$$= \Pi_{normal} + Wd_W - Md_M \quad \text{.....(22)}$$

where,

Em	=	Earnings of men,
Ew	=	Earnings of women,
Π	=	Profit.
MRP	=	Marginal Revenue Product,
d	=	Discrimination coefficient,
QR	=	Total revenue.

The above formulation of income transfer has led economists like Jermiha Cotton to label dm as overvaluation of males' attributes and dw as under valuation of females' attributes (see section 3.3).

Given the above theoretical background on how the theory of discrimination evolved in the economic literature, it is desirable to highlight the impacts of discrimination on the economy in general and women in particular before going to the next section.

Prices including wages are the prime signals for efficient allocation of resources in an economy. If wages are discriminatory, i.e., distorted, then the labour market will fail to allocate labour efficiently in the economy and Pareto efficiency will not be attained. If Pareto efficiency is not attained, it means that the potential to produce the maximum output (welfare) is lost. Hence, eliminating discrimination would improve the welfare of the society. In this regard, Psacharopoulos and Tzannatos have stated that

> there is bound to be an efficiency loss (lower level of production) from restricting labour market based on non-economic criteria (such as sex). Unjustified differentials, do therefore, provide grounds for corrective policies from an economic (Pareto) point of view... if women competed with men with an equal footing, men would have a smaller share of the pie, but the size of the pie will be greater as the allocative mechanism of the market will improve (Psacharapoulos and Tzannatos, 1992 : 137-138).

3.2. Review of Empirical Literature

Based on the above theoretical models and using different econometric methods researchers established lots of empirical evidence on wages differential in developed and developing countries. This review mainly focuses on some of the findings in developing countries.

Fuch (1971) found out that 3-15% of differences in male-female wage differential was not attributed to productivity-related attributes. Similarly Oaxaca (1973) and Mincer and Polachek found it to be 80-94 and 55 per cent respectively. These are the pioneering works conducted in USA. Since these works various estimates have also been made. Blau has extensively reviewed these studies and concluded that, "the evidence reviewed here strongly suggests that labour market discrimination does indeed play a role in producing the observed male-female pay differential" (Blau, 1984: 129).

In developing countries, empirical studies have been done on 15 countries in Latin America and on seven countries in East Asia. Psacharopoulos and Tzannatos (1992) found out that, correcting for selectivity, about 88 percent of the wage gap in Latin America is attributed to discrimination. Horton (1994) found out that at least 50% of the wage gap in Asia is attributed to the same factor, (Appletton, Hoddinott, Krishnan, 1996: 1). The case studies edited by Psacharopoulos and Tzannatos showed that gender discrimination in the labour market varies from country to country. It ranged from 93% in Costa Rica to about 23 % in Colombia. Some of the research results produced in Latin America are presented the table below.

Table 20

Empirical Evidences on Wage Differential in Latin America

Country	Wage Differential (%) Explained by	
	Endowments	Rewards
Bolivia	14.9	85.1
Argentina	26	74
Brazil 1980 Data	33	68
Brazil 1989 Data	19	81
Colombia	77.1	22.9
Costa Rica	6.7	93.3
Equador	36.7	62.3
Guatemala	55.4	44.6

Source: Psacharapoulos and Tzannatos, 1992.

Table 21 shows that it is only in two countries, namely Colombia and Guatemala, that greater proportion of the wage gap is explained by differences in productivity enhancing endowments. Even in these two countries, discrimination in the labour market has a significant share in explaining the observed wage gap.

Case studies conducted in Africa are very limited. Knight and Sabot (1982), using 1971 data from sample industries in Tanzania found out that 17% of wage gap is not attributable to observable productive-enhancing factors. Armitage and Sabot (1991), on the other hand, argued that the above wage differential had disappeared (Appleton and et.al, 1992:1).

A recent study conducted by Appleton, Hodinott and Krishnan is one of the studies that use the most recent methodology. They have estimated the gender wage gap in Cote d'Ivoire, Ethiopia and Uganda. They extend Oaxaca-Ransom's (1994) method by accounting sectoral choice differences by men and women. They concluded that "differences between actual and gender neutral returns account for much of gender gap in Ethiopia [46%] and Uganda [73%], rather less in Cote d'voire [20%]. In all the three countries, wage differential due to differences in actual and predicted sectors for women narrows the wage gap because women are over represented in better paid public sector" (Appleton, Hoddinott and Krishnan, 1996, P : 7). The full result of their study is presented in Table 21.

Table 21

Full Decomposition of the Gender Wage Gap

No.		Ethiopia	Cote d'Ivoire	Uganda
1	Differences in log of offered wages	0.522	0.322	0.270
2	Differences due to differences in:			
2.1	Differences due to differences in characteristics	0.045(9%)	0.138(43%)	0.063(23)
2.2	actual and gender neutral returns to male characteristics	0.243(47%)	0.27(8%)	0.064(24%)
2.3	actual and gender neutral returns to female characteristics	0.237(46%)	0.065(20%)	0.194(73%)
2.4	characteristics that generate different sectoral choice	0.017(3%)	0.092(29%)	0.017(6%)
2.5	differences in actual and predicted sector for men	0.013(2%)	0.048(15%)	-0.001(0%)
2.6	differences in actual and predicted sector for women	-0.034(-7%)	-0.048(-15%)	-0.068(-26%)

Source: Appleton, Hoddinott and Krishanan, 1996, P. 10.

3.3. Model Specification

The theoretical formulation of labour market discrimination initiated by Becker and elaborated by others has led many empirical researchers to come up with different methodologies to measure the extent to which females or other minority groups are discriminated. The methods used in many empirical works and the methods which this paper are going to use are discussed below.

Empirical evidence such as differences in wage rate among socio-economic groups or sectors of the economy is consistent with labour market segmentation but does not prove its existence. It is, therefore, important to look into returns to labour between sexes and compare their differences. In this regard, the empirical analysis conducted so far use three main methods.

The first one calls for running a regression of earnings upon the characteristics of all (male and female) workers and include a separate variable showing the sex of the worker in such a way that

$$\ln(W) = \beta_0 + X_i B_i + f b_{2i} + e_i \quad \text{.....(23)}$$

where,

W = workers earnings
X_i = productivity enhancing attributes
f_i = a dummy variable taking the value of 1 if the worker is female and 0 otherwise
e_i = holds unmeasurable characteristics
B_i & b_2 = are estimated coefficients

The litmus test for wage differential lies on the estimated coefficient b_2. If $b_2<0$, it is interpreted that women on the average earn lower wages than men. This approach requires the comparison of men and women earnings of the same characteristics. If this does not hold, then b_2 will be a biased estimate.

The second approach calls for separate treatment of the earning functions for men and women, the estimated coefficients being the earning structures of men and women. It is then necessary to compare the coefficients of the two equations and test whether they are significantly different from each other. If the difference is statistically significant, it means that the rewards to human capital are different for men and women. This comparison does not, however, indicate the relative importance of discrimination in explaining the observed gap (Grootaert, 1986: 223-224).

The third approach is mainly based on the seminar work of Becker's labour market discrimination. He developed what he termed as the "discrimination coefficient". From Becker's discrimination coefficient, Oaxaca formulated the well-known "Oaxaca decomposition" method. This method depends on the earning structures of men and women in relation to the average wage. The approach estimates separate functions for men and women by OLS.

$$\ln(W_m) = X_m \beta_m + e_m \quad \text{.....(24)}$$

and

$$\ln(W_f) = X_f \beta_f + e_f \quad \text{.....(25)}$$

Where, β_m and β_f are vector of unknown coefficients,

X_m and X_f are vector of males and females endowment characteristics

e_m and e_f are the males' and females' individual specific errors.

The property of ordinary least squares regression analysis guarantee that the regression line passes through the mean values of wages. Thus,

$$\ln \overline{W_m} = \overline{X_m \beta_m} \quad \text{.....(26)}$$

$$\ln \overline{W_m} = \overline{X_m} \beta_m \quad \text{.....(27)}$$

Where, $\overline{W}$ and $\overline{X}$ represent average wage and average productive enhancing characteristics respectively.

If females receive the same returns for their endowments of wage determining characteristics that is if the pay structure is the same, then females average wage would be

$$W_f^* = \beta_m \overline{X_f} \quad \text{.....(28)}$$

W_f^* is, therefore, the amount of wage that should prevail in the labour market on condition that there is no discrimination in the labour market between the two sexes.

$\overline{W_m} - W_f^*$ would therefore be the difference between the average male earnings and average hypothetical female earnings on the basis of the male pay structure. This could also be done by using the female pay structure or the weighted average of the two pay structures. The difference reflects the wage differential between men and women attributed to the difference in productivity enhancing endowments (characteristics).

$\overline{W_f}^* - \overline{W_f}$ gives the difference between the "non-discriminatory" hypothetical female wage and their actual earnings. This is the wage differential explained by different pay structures between men and women.

The estimation and decomposition of wage differential using Oaxaca's approach and male-pay structures calls for the running of the regression of the following type:

$$Ln(W_m) - Ln(W_f) = b_m\left(\overline{X_m} - \overline{X_f}\right) + \left(b_m - b_f\right)\overline{X_f} \quad \text{.....29}$$

Where:-

$\ln(W_m) - \ln(W_f)$ = Total wage gap

$b_m\left(\overline{X_m} - \overline{X_f}\right)$ = Wage gap explained by endowments which is often referred to as the "non discrimination" by the labour market but caused by discriminatory practices of families and communities during human capital formation (human capital discrimination).

$(b_m - b_f)\overline{X_f}$ = The part of the wage gap explained by differences in wage payment structures and this is what is called "the discrimination" of women in the labour market. This gap is often referred to as the upper bound since there could be omitted characteristics.

The major criticism of Oaxaca's decomposition method is that the method failed to portray Becker's original condition of the wage structure that should prevail in the absence of discrimination. Becker's discrimination coefficient method clearly states that in the absence of discrimination males and females of the same attributes are perfect substitutes and when they are hired at random the market wage rate in the competitive market for both sexes will be the same ($w = w_m = w_f$). Oaxaca's original method uses either the male or the female wage rate in the presence of discrimination as a non-discriminatory wage rate. This is usually referred to as the index "number problem".

Following such criticism, Cotton (1988) and Oaxaca and Ransom (1994) have developed a way to overcome the index number problem. Both researchers have predicted the discrimination neutral wage rate B* from their information.

For Cotton $B^* = f_m B_m + f_f B_f$ and for Oaxaca and Ransom $B^* = \Omega B_m + (1-\Omega)B_f$. f_m and f_f are the proportion of men and female in the labour force with Ω a weighing matrix estimated as$\Omega=(X' X)^{-1}$ (Xm'Xm). X is the observation matrix from the pooled sample. The use of such discrimination neutral wage rate as a numeraire enabled these researchers to decompose the discrimination component into two. Cotton in particular has stated that discrimination is made up of what he termed the "over valuation" and "under valuation" of male and female productive characteristics, i.e.,

$$\ln W_m - \ln W_f = B^*(\overline{X_m} - \overline{X_f}) + \overline{X_m}(B_m - B^*) + \overline{X_f}(B^* - B_f) \quad \text{.....(30)}$$

where,

$B^*(\overline{X_m} - \overline{X_f})$ = differences in attributes

$\overline{X_m}(B_m - B^*)$ = "overvaluation" of males attributes

$\overline{X_f}(B_f - B^*)$ = "undervaluation" of females attributes

Appleton, Hoddinott and Krishnan (1996) developed the Oaxaca and Ransom's model further by including into (30) gender differences in characteristics determining sectoral structures (Appleton, Hoddinott and Krishnan, 1996).

All the above decomposition methods have one major shortcoming- the problem of omitted variables. Since the discrimination measure is the residual, for it to be the correct measure all the factors that determine wage should be properly accounted for (Cotton, 1988). If relevant variables are excluded, it means that the parameter estimates will be biased upwards or downwards depending on the variables excluded. If for instance, on the average, males possess more productivity enhancing attributes but excluded in the model, an overestimation of discrimination results. If on the other hand, the opposite is true, then the result will be an underestimation. This problem has not been resolved in many empirical researches so far but caution is always made on the interpretation of the results. The residual is often interpreted as the upper bound of discrimination.

This paper will attempt to use all the three methods in estimating the gender wage gap and see whether it is possible to estimate a pooled regression equation for both men and women. The Cotton method will be used to decompose the wage-gap into its three main components: the difference in attributes, males advantage and females disadvantage.

3.4. Estimated Results

The data problem mentioned in the previous chapter also holds here. In addition, the econometric problem faced in this section is the index number problem - the wage rate that should be considered as non-discriminatory. Two approaches have been forwarded by researchers. The basic difference of the Oaxaca's-Ransom's (1994) and the Cotton (1988) methods is the estimated non-discriminatory wage rate. The Oaxaca-Ransom (1994) method estimates the non-discriminatory wage rate from the variance - covariance matrix of the given sample. Given the data limitations of the sample, this method is not considered.

Instead, the Cotton method is adopted. The proportion of female and male labour force is not taken from this sample. This parameter is calculated from the population census of 1994. The total, female and male labour force of the seven major cities/ towns is extracted from the census and the statistic is calculated from that information. It was found that males constitute about 48 percent of the total labour force, and females 52 percent.

The descriptive statistics of the study including the wage gap was presented in section 2.4. Reference can, therefore, be made to that section.

The existence of gender discrimination can be identified using a least square regression by including a sex dummy in the wage equation. It was stated earlier that if the coefficient of this dummy turns out to be significantly negative, it implies the existence of discrimination in wage structures among otherwise equally competitive groups.

The OLS estimate shows that the coefficient of the variable is positive and not significant. This result suggests that, given the data set used, the labour market in the Ethiopian major urban centres is not discriminatory. See Table 22 for the regression result. It would be gross generalisation and inappropriate to be conclusive about the issue from this regression. So, there is a need to go beyond this method.

Table 22
The Simple Regression Method

Variable	Coefficient
CONSTANT	-0.092044
	(-2.915)
PRED	0.004117
	(1.112)
SECED	0.0089391
	(2.578)
HIGHED	0.062498
	(6.124)
EXPP	-0.0025497
	(-1.678)
EXPP2	0.000031382
	(1.066)
PATED	0.0013917
	(0.694)
MATED	0.011010
	(2.057)
FATHOCC	0.0023043
	(0.267)
MOTHOCC	-0.015591
	(-1.298)
OCCCAT	0.048408
	(2.297)
EXPF	0.0067768
	(1.561)
EXPNF	-0.013713
	(-4.160)
MIG	-0.21104
	(-3.712)
REMIT	-0.000037660
	(-1.351)
BMI	0.00000
	(0.531)
HEIGHT	0.00010952
	(0.798)
MRTST	-0.0016716
	(-0.105)
FIRMSIZE	-0.011207
	(-1.775)
SEX	0.014103
	(1.076)

-figures in parenthesis are t-ratios.

The second way of looking into the existence of wage differential by gender is to test whether we can pool the regression equations of men and women. This can be done using tables A1 to A10 in the Annex. The Wald test has not rejected, for example, the equality of returns to different levels of education between males and females. This result suggests again that the available data does not support the existence of differential payment structures for education between these groups.

Oaxaca's (1973) method shows that about 90 percent of the observed wage gap is explained by observed differences in personal, family and firm specific characteristics. This is the minimum limit of the contribution of observed differences to the observed wage gap as there may be omitted variables.

Table 23
Decomposition of the Wage Gap - Basic Oaxaca Model
Using Male Pay Structure

	Components of the Wage Gap	Percentage
1	Not corrected for selectivity bias	
	1.1 Due to attributes	88
	1.2 Due to discrimination	12
	1.3 Total	100
2	Corrected for selectivity bias	
	2.1 Due to attributes	91
	2.2 Due to discrimination	9
	2.3 Total	100

The above method is criticised for using a non-discriminatory wage rate. For instance, in the above estimation men's wage rate is taken as non-discriminatory. If one uses females wage rate, the result will be different. Hence Cotton and Oaxaca and Ransom (1994) have come up with a procedure for the estimation of the non-discriminatory wage rate. This paper uses the Cotton's method. Accordingly, the non -discriminatory wage rate is estimated by weighing the estimated coefficients of each group by their respective shares in the labour force.

In this case too, the estimated result shows that the observed attribute differential explain more than 80 percent of the observed wage gap whether or not selectivity bias is controlled.

It also suggests that discrimination, at most, explains 20 percent of the observed wage gap; 73% of which emanated from the overvaluation of men's characteristics and 37% of it originated from the "under valuation" of women's attributes.

Table 24

Decomposition of the Wage Gap - Cotton's Procedure

Components of the Wage Gap	Corrected for Selectivity Bias	Not Corrected for Selectivity Bias
Due to skill differences	80	84.3
Due to male advantage	14.6	12.2
Due to female disadvantage	5.4	4.5
Total	100	100

CHAPTER - 4

IV. CONCLUSIONS AND POLICY IMPLICATIONS

The study entails two main objectives, namely estimation and analysis of private returns to education and investigating the existence and source of male-female wage differential in the Ethiopian urban labour market. The results of the exercise are presented in Chapters two and three. Summary results and policy implication, thereof, are provided below.

i. Whether education is defined as additional a year schooling or as years spent at various levels of education, the study confirms that educational investment pays for an individual. Each additional year of schooling is found to provide about 10.5 percent of private rate of return if one uses the preferred model. Again using the preferred MLE estimators, the rate of return for primary, secondary and higher education are found to be 5, 10.6 and 31 percent respectively. While the private rate of return for secondary and higher education is found to be significant at conventional levels, the rate of return for primary education is only significant at 10 percent significance level. Although the hazard ratio is not significant on its own, it is found out that the estimated rates of return to education are sensitive to the inclusion of sample selection correction.

ii. The estimated rate of return to various levels of education does not follow the conventional pattern. Conventional estimates reported that the rate of return for primary education is larger than the return on higher levels of education. The estimated result for this study is quite the contrary. The rate of return for education increases as one goes higher in the education ladder and primary education is the least in this regard. This result has implications on the allocation of resources in the schooling system.

iii. The estimates have also shed light on whether there is gender differential in returns to education. When education is defined as one year of additional schooling, the gender parity index ranges from 13 to 39 per cent implying that males on the average have a higher rate of return to education as compared to females. All the three estimation methods seem to support these finding. The statistical tests, however, provide a mixed result. While the Chow test on OLS and Heckit models established the existence of gender differential in returns to schooling, the Wald test on MLE estimates rejects it.

When education is defined as years spent at different levels of education, the rate of return for primary education was significant for males and insignificant for females in all the three methods implying that primary education does contribute little to female incomes. When we go higher in the educational ladder, the three methods stipulate that the return for female education is higher than male education. The return for female education was found to be 12.1 per cent for secondary and 38.4 percent for higher education. The respective figure for males is 8.7 and 28.6 percent. Here again, the statistical test does not reject the equality of the two estimates.

The conclusion that comes out here is that female own education in Ethiopia has at least the same rate of return to education and the rate of return does not explain the enrolment differential that is observed in the Ethiopian school system. The reason for lower female enrolment should lie elsewhere.

iv. The simple Mincerian function explains small proportions of incomes. The extended model, which accounted for different own personal, demographic, parental, firm specific characteristics, is a more appropriate earning function. Of all characteristics included, the important contribution to earnings comes from maternal education, occupational category, firm level experience and firm size. Two significant conclusions can emerge from this analysis.

   a) The Ethiopian labour market does not seem to reward other forms of human capital variables (health as proxied by BMI and height, job search as proxied by migration).

   b) Although both maternal and paternal education is included in the extended model, paternal education is found to have little contribution to children's income in all the three methods. Maternal education on the other hand, has a significant impact, which ranges between 3.8 and 6.4 percent. This is a direct effect. Of all the variables considered, it is only maternal education that has significant indirect effect on children's earnings. This finding clearly shows that the importance of female education is not limited to own private return but extends into subsequent generation.

v. It is observed that there is female - male wage differential in earnings in Ethiopia. Both the OLS regression and the test for pooling the two categories show that the

evidence from the available data does not support the existence of gender discrimination in the Ethiopian labour market. The Oaxaca (1973) method, using male pay structure, established that more than 88 percent of the pay differential can be explained by differences in attributes. The Cotton method also supports this result and about 80 percent of the wage gap is explained by skill differentials.

As there could be other relevant variables excluded from the model, this discrimination component could decline as one includes more of such variables. The conclusion, therefore, is that discrimination exists in Ethiopia. This discrimination is not however post-market discrimination that reflects itself in payment structures. But rather it is pre-market discrimination reflected in differences in human capital formation.

Given the data problem explained throughout this paper, it is difficult to provide conclusive policy recommendations. The above findings, however, lend themselves to some broad policy implications. These main policy implications include the following.

1. The mere expansion of primary education may not be an appropriate policy measure to improve the livelihood of the population. This does not in any way imply that investment in primary education should be curtailed altogether. What it implies is that the returns to primary education need to be revitalised by either improving the quality of education at that level or by matching the curriculum with job opportunities in the economic sphere. These would mean constructing additional facilities in crowded urban schools, acquisition and distribution of books and other teaching materials, training and employment of more qualified teachers, and development and implementation of employment oriented curriculum. The government therefore needs to reassess its allocation of resources within primary education and among different levels of education.

2. The returns to female education go beyond one's own benefit. It has a long run effect on children. This suggests that the government needs to encourage the education of females and commit resources to that end.

3. The return to higher education is more pronounced than lower levels of education. This in principle clearly supports the intention of the governments to introduce cost-sharing arrangements at higher education . But as this study based itself on 1994 urban household survey, the implementation of this arrangement requires that the supply and demand conditions of educated labour in the labour market to

improve or at least to remain stable over the long run. The implication of this study is more general should not be taken at its face value

4. The result of this study, based on the urban household survey, suggests that observed earning differential in Ethiopia is largely a result of pre-market discrimination by parents in human capital formation in females. This has to be changed. Every effort needs to be done to change the attitude of parents so that they send more girls to the school. The government, in this regard, can do a lot through its organisational structures and resource commitments towards supporting the education of girls.

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Table - A.1

PROBIT FUNCTION FOR MEN
(OLS ESTIMATES)

Dependent variable is binary, y=0 or y not equal 0
Ordinary least squares regression Weighting variable = ONE
Dependent variable is DUMEMP Mean = 0.16134, S.D. = 0.367
Model size: Observations = 2473, Parameters = 13, Deg.Fr. = 246
Residuals: Sum of squares= 251.034 Std.Dev. = 0.3194
Fit: R-squared = 0.24980, Adjusted R-squared = 0.2461
Model test: F[12, 2460] = 68.26, Prob value = 0.0000
Diagnostic: Log-L = -680.4214, Restricted(Ã=0) Log-L = -1035.814
Amemiya Pr. Crt.= 0.103, Akaike Info. Crt.= 0.56

Variable	Coefficient	Standard Error	z=b/s.e.	P[°Z°·z]	Mean of
Constant	0.12195	0.33991E-01	3.588	0.00033	
MRTST	0.31738E-01	0.21103E-01	1.504	0.13260	0.3397
YEARMIG	0.49127E-01	0.23782E-02	20.657	0.00000	1.241
MIG	0.26935E-01	0.37274E-01	0.723	0.46992	0.5621E-01
PRED	0.12268E-02	0.49347E-02	0.249	0.80367	5.095
SECED	-0.52300E-03	0.34682E-02	-0.151	0.88013	3.269
HIGED	0.18730E-02	0.85481E-02	0.219	0.82656	0.2394
PATED	-0.38893E-02	0.22084E-02	-1.761	0.07821	1.371
MATED	-0.72725E-02	0.49975E-02	-1.455	0.14561	0.2932
NOELDER	-0.10652E-02	0.58552E-02	-0.182	0.85565	0.2636
AGE	-0.17366E-02	0.85215E-03	-2.038	0.04155	30.80
MOTHOCC	-0.44519E-02	0.10690E-01	-0.416	0.67707	0.2503
FATHOCC	0.24299E-01	0.73624E-02	3.300	0.00097	0.9668

Table - A.2

PROBIT FUNCTION FOR MEN
(MLE ESTIMATES)

Binomial Probit Model	
Maximum Likelihood Estimates	
Dependent variable	DUMEMP
Number of observations	2473
Iterations completed	6
Log likelihood function	-863.3786
Restricted log likelihood	-1092.792
Chi-squared	458.8276
Degrees of freedom	12
Significance level	0.0000000
Results retained for SELECTION model.	

Variable	Coefficient	Standard Error	z=b/s.e.	P[°Z°·z]	Mean of X
Constant	-1.1685	0.17738	-6.588	0.00000	
MRTST	0.16175	0.11180	1.447	0.14794	0.3397
YEARMIG	0.15264	0.10310E-01	14.805	0.00000	1.241
MIG	0.86136E-01	0.15293	0.563	0.57326	0.5621E-01
PRED	0.59488E-02	0.25584E-01	0.233	0.81613	5.095
SECED	-0.31008E-02	0.17995E-01	-0.172	0.86319	3.269
HIGED	0.13199E-01	0.44130E-01	0.299	0.76486	0.2394
PATED	-0.22744E-01	0.12256E-01	-1.856	0.06348	1.371
MATED	-0.59549E-01	0.34387E-01	-1.732	0.08332	0.2932
NOELDER	-0.11049E-01	0.33344E-01	-0.331	0.74036	0.2636
AGE	-0.88873E-02	0.45569E-02	-1.950	0.05114	30.80
MOTHOCC	-0.24049E-01	0.57264E-01	-0.420	0.67451	0.2503
FATHOCC	0.11771	0.36107E-01	3.260	0.00111	0.9668

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted		
Actual	0	1	TOTAL
0	2006	68	2074
1	244	155	399
TOTAL	2250	223	2473

Table - A.3

EARNING FUNCTION FOR MEN
(ESTIMATES BY ORDINARY HECKMAN'S TWO-STEP PROCEDURE)

Sample Selection Model
Two stage least squares regression Weighting variable = ONE
Dependent variable is INCOME Mean = -0.25393, S.D. = 1.267
Model size: Observations = 399, Parameters = 20, Deg.Fr. = 37
Residuals: Sum of squares= 323.847 Std.Dev. = 0.9243
Fit: R-squared = 0.46668, Adjusted R-squared = 0.4399
Note: Not using OLS. R-squared is not bounded in [0,1]
Model test: F[19, 379] = 17.45, Prob value = 0.0000
Diagnostic: Log-L = -524.5226, Restricted(Ã=0) Log-L = -660.194
Amemiya Pr. Crt.= 0.897, Akaike Info. Crt.= 2.72
Standard error corrected for selection..... 0.93134
Correlation of disturbance in regression
and Selection Criterion (Rho)..... -0.14771

Variable	Coefficient	Standard Error	z=b/s.e.	P[°Z°·z]	Mean of X
Constant	-2.1634	0.26422	-8.188	0.00000	
PRED	0.64445E-01	0.35520E-01	1.814	0.06963	5.113
SECED	0.42328E-01	0.25779E-01	1.642	0.10060	3.203
HIGED	0.40392	0.67039E-01	6.025	0.00000	0.2356
EXPP	0.59428E-02	0.11797E-01	0.504	0.61443	14.04
EXPP2	-0.16347E-03	0.24610E-03	-0.664	0.50655	385.5
PATED	0.18401E-01	0.16048E-01	1.147	0.25156	1.175
MATED	0.33171E-01	0.48618E-01	0.682	0.49507	0.2030
FATHOCC	-0.21912E-01	0.46797E-01	-0.468	0.63961	1.065
MOTHOCC	-0.18159	0.85849E-01	-2.115	0.03441	0.2632
OCCCAT	0.33282	0.40446E-01	8.229	0.00000	1.925
EXPF	0.36735E-01	0.59486E-02	6.175	0.00000	9.253
EXPNF	-0.14698E-02	0.45417E-02	-0.324	0.74621	4.860
MIG	-0.16681	0.13447	-1.241	0.21479	0.2331
REMIT	-0.63782E-04	0.40669E-04	-1.568	0.11680	365.4
BMI	0.81857E-06	0.51365E-05	0.159	0.87338	520.4
HEIGHT	0.16103E-02	0.78086E-03	2.062	0.03919	138.0
MRTST	-0.10944	0.14136	-0.774	0.43882	0.3409
FIRMSIZE	0.10045	0.20168E-01	4.981	0.00000	4.356
LAMBDA	-0.13756	0.93758E-01	-1.467	0.14231	1.181

Table - A.4

MARGINAL EFFECTS OF THE HECKIT MODEL FOR MEN
(1-19 ARE DIRECT EFFECTS,20-32 AREINDIRECT
EFFECTS,33-41 ARE TOTAL EFFECTS)

Variable	Coefficient	Standard Error	z=b/s.e.	P[°Z°·z]	Mean of X
Constant	-2.1634	0.26422	-8.188	0.00000	
PRED	0.64445E-01	0.35520E-01	1.814	0.06963	5.113
SECED	0.42328E-01	0.25779E-01	1.642	0.10060	3.203
HIGED	0.40392	0.67039E-01	6.025	0.00000	0.2356
EXPP	0.59428E-02	0.11797E-01	0.504	0.61443	14.04
EXPP2	-0.16347E-03	0.24610E-03	-0.664	0.50655	385.5
PATED	0.18401E-01	0.16048E-01	1.147	0.25156	1.175
MATED	0.33171E-01	0.48618E-01	0.682	0.49507	0.2030
FATHOCC	-0.21912E-01	0.46797E-01	-0.468	0.63961	1.065
MOTHOCC	-0.18159	0.85849E-01	-2.115	0.03441	0.2632
OCCCAT	0.33282	0.40446E-01	8.229	0.00000	1.925
EXPF	0.36735E-01	0.59486E-02	6.175	0.00000	9.253
EXPNF	-0.14698E-02	0.45417E-02	-0.324	0.74621	4.860
MIG	-0.16681	0.13447	-1.241	0.21479	0.2331
REMIT	-0.63782E-04	0.40669E-04	-1.568	0.11680	365.4
BMI	0.81857E-06	0.51365E-05	0.159	0.87338	520.4
HEIGHT	0.16103E-02	0.78086E-03	2.062	0.03919	138.0
MRTST	-0.10944	0.14136	-0.774	0.43882	0.3409
FIRMSIZE	0.10045	0.20168E-01	4.981	0.00000	4.356
Constant	-0.13080	0.14373	-0.910	0.36280	
MRTST	0.18105E-01	0.89714E-01	0.202	0.84006	0.3397
YEARMIG	0.17086E-01	0.85201E-02	2.005	0.04492	1.241
MIG	0.96414E-02	0.12702	0.076	0.93950	0.5621E-01
PRED	0.66587E-03	0.20853E-01	0.032	0.97453	5.095
SECED	-0.34708E-03	0.14660E-01	-0.024	0.98111	3.269
HIGED	0.14774E-02	0.36091E-01	0.041	0.96735	0.2394
PATED	-0.25458E-02	0.98622E-02	-0.258	0.79630	1.371
MATED	-0.66655E-02	0.27997E-01	-0.238	0.81182	0.2932
NOELDER	-0.12368E-02	0.26828E-01	-0.046	0.96323	0.2636
AGE	-0.99478E-03	0.36831E-02	-0.270	0.78709	30.80
MOTHOCC	-0.26919E-02	0.46143E-01	-0.058	0.95348	0.2503
FATHOCC	0.13175E-01	0.29660E-01	0.444	0.65689	0.9668
PRED	0.65111E-01	0.41189E-01	1.581	0.11393	5.113
SECED	0.41981E-01	0.29656E-01	1.416	0.15689	3.203
HIGED	0.40540	0.76137E-01	5.325	0.00000	0.2356
PATED	0.15855E-01	0.18837E-01	0.842	0.39995	1.175
MATED	0.26505E-01	0.56103E-01	0.472	0.63661	0.2030
FATHOCC	-0.87370E-02	0.55405E-01	-0.158	0.87470	1.065
MOTHOCC	-0.18428	0.97464E-01	-1.891	0.05866	0.2632
MIG	-0.15717	0.18498	-0.850	0.39551	0.2331
MRTST	-0.91332E-01	0.16742	-0.546	0.58540	0.3409

Table - A.5

EARNING FUNCTION FOR MEN
(MLE ESTIMATES)

Variable	Coefficient	Standard Error	z=b/s.e.	P[°Z°·z]	Mean of X
Constant	-1.7659	0.31165	-5.666	0.00000	
PRED	0.89494E-01	0.40259E-01	2.223	0.02622	
SECED	0.87271E-01	0.28160E-01	3.099	0.00194	
HIGED	0.28557	0.73904E-01	3.864	0.00011	
EXPP	0.47362E-02	0.13164E-01	0.360	0.71901	
EXPP2	-0.32287E-03	0.28608E-03	-1.129	0.25907	
PATED	0.14890E-01	0.15745E-01	0.946	0.34430	
MATED	0.28093E-01	0.52139E-01	0.539	0.59002	
FATHOCC	-0.57787E-02	0.52320E-01	-0.110	0.91205	
MOTHOCC	-0.63615E-01	0.10865	-0.586	0.55821	
OCCCAT	0.29364	0.42665E-01	6.882	0.00000	
EXPF	0.27358E-01	0.67707E-02	4.041	0.00005	
EXPNF	-0.16625E-02	0.51845E-02	-0.321	0.74847	
MIG	-0.25127	0.14379	-1.747	0.08056	
REMIT	-0.35260E-04	0.60862E-04	-0.579	0.56236	
BMI	0.34876E-06	0.28089E-02	0.000	0.99990	
HEIGHT	0.14200E-02	0.86469E-03	1.642	0.10056	
MRTST	0.78476E-01	0.15527	0.505	0.61326	
FIRMSIZE	0.28960E-01	0.22108E-01	1.310	0.19022	
Sigma(1)	0.76960	0.45364E-01	16.965	0.00000	
Rho(1,2)	-0.21065	0.12374	-1.702	0.08870	

Table - A.6

PROBIT FUNCTION FOR FEMALES
(OLS ESTIMATES)

¤ Dependent variable is binary, y=0 or y not equal 0
¤ Ordinary least squares regression Weighting variable = ONE
¤ Dependent variable is DUMEMP Mean = 0.14838, S.D. = 0.355
¤ Model size: Observations = 3053, Parameters = 13, Deg.Fr. = 304
¤ Residuals: Sum of squares= 286.695 Std.Dev. = 0.3071
¤ Fit: R-squared = 0.25685, Adjusted R-squared = 0.2539
¤ Model test: F[12, 3040] = 87.56, Prob value = 0.0000
¤ Diagnostic: Log-L = -721.1443, Restricted(Ã=0) Log-L = -1174.299
¤ Amemiya Pr. Crt.= 0.095, Akaike Info. Crt.= 0.48

Variable	Coefficient	Standard Error	z=b/s.e.	P[°Z°·z]	Mean of X
Constant	0.67510E-01	0.25523E-01	2.645	0.00817	
MRTST	-0.16596E-01	0.13524E-01	-1.227	0.21975	0.3066
YEARMIG	0.48015E-01	0.21160E-02	22.691	0.00000	1.192
MIG	0.44256E-01	0.32504E-01	1.362	0.17333	0.5667E-01
PRED	0.53020E-02	0.34693E-02	1.528	0.12645	4.012
SECED	-0.49778E-02	0.32424E-02	-1.535	0.12473	2.235
HIGED	-0.18425E-03	0.12132E-01	-0.015	0.98788	0.9564E-01
PATED	-0.37764E-02	0.18592E-02	-2.031	0.04224	1.478
MATED	0.43526E-02	0.38238E-02	1.138	0.25500	0.3747
NOELDER	-0.25538E-02	0.46925E-02	-0.544	0.58628	0.3295
AGE	-0.19362E-04	0.62538E-03	-0.031	0.97530	30.19
MOTHOCC	0.12330E-01	0.86812E-02	1.420	0.15551	0.2912
FATHOCC	0.17457E-01	0.66593E-02	2.621	0.00876	1.023

Table - A.7

PROBIT FUNCTION FOR FEMALES
(MLE ESTIMATES)

Binomial Probit Model	
Maximum Likelihood Estimates	
Dependent variable	DUMEMP
Number of observations	3053
Iterations completed	5
Log likelihood function	-1001.935
Restricted log likelihood	-1281.913
Chi-squared	559.9554
Degrees of freedom	12
Significance level	0.0000000
Results retained for SELECTION model.	

Variable	Coefficient	Standard Error	z=b/s.e.	P[°Z°·z]	Mean of X
Constant	-1.4685	0.14325	-10.251	0.00000	
MRTST	-0.85071E-01	0.75217E-01	-1.131	0.25805	0.3066
YEARMIG	0.15261	0.95670E-02	15.952	0.00000	1.192
MIG	0.13041	0.13963	0.934	0.35032	0.5667E-01
PRED	0.29364E-01	0.19118E-01	1.536	0.12455	4.012
SECED	-0.29615E-01	0.18045E-01	-1.641	0.10077	2.235
HIGED	0.11627E-01	0.67507E-01	0.172	0.86325	0.9564E-01
PATED	-0.24181E-01	0.11373E-01	-2.126	0.03349	1.478
MATED	0.22130E-01	0.20775E-01	1.065	0.28678	0.3747
NOELDER	-0.11801E-01	0.25913E-01	-0.455	0.64881	0.3295
AGE	-0.67949E-04	0.34637E-02	-0.020	0.98435	30.19
MOTHOCC	0.63633E-01	0.46838E-01	1.359	0.17428	0.2912
FATHOCC	0.89373E-01	0.35330E-01	2.530	0.01142	1.023

Frequencies of actual & predicted outcomes
Predicted outcome has maximum probability.

	Predicted		
Actual	0	1	TOTAL
0	2519	81	2600
1	281	172	453
TOTAL	2800	253	3053

Table - A.8

EARNING FUNCTION FOR WOMEN
(ORDINARY HECKMAN'S TWO-STEP PROCEDURE ESTIMATES)

```
¤ Sample Selection Model
¤ Two stage   least squares regression     Weighting variable = ONE
¤ Dependent variable is INCOME     Mean =   -0.35789, S.D. =       1.096
¤ Model size: Observations =      453, Parameters =  20, Deg.Fr. =    43
¤ Residuals:  Sum of squares=     334.448      Std.Dev. =          0.8788
¤ Fit:        R-squared = 0.35629, Adjusted R-squared =          0.3280
¤             Note:  Not using OLS.  R-squared is not bounded in [0,1]
¤ Model test: F[ 19,    433] =   12.61,     Prob value =          0.0000
¤ Diagnostic: Log-L =   -574.0566, Restricted(Ã=0) Log-L =     -684.059
¤             Amemiya Pr. Crt.=    0.806, Akaike Info. Crt.=       2.62
¤ Standard error corrected for selection.....   0.87975
¤ Correlation of disturbance in regression
¤ and Selection Criterion (Rho).............    0.54278E-01
```

Variable	Coefficient	Standard Error	z=b/s.e.	P[°Z°·z]	Mean of X
Constant	-1.2388	0.22629	-5.474	0.00000	
PRED	-0.31872E-02	0.25949E-01	-0.123	0.90225	3.956
SECED	0.82029E-01	0.26424E-01	3.104	0.00191	2.110
HIGED	0.44211	0.97225E-01	4.547	0.00001	0.8830E-01
EXPP	-0.27767E-01	0.10461E-01	-2.654	0.00794	15.67
EXPP2	0.25869E-03	0.20899E-03	1.238	0.21579	467.0
PATED	-0.17602E-01	0.16067E-01	-1.095	0.27330	1.267
MATED	0.72638E-01	0.25602E-01	2.837	0.00455	0.5099
FATHOCC	0.44689E-01	0.46515E-01	0.961	0.33669	1.141
MOTHOCC	0.79704E-01	0.62439E-01	1.277	0.20178	0.3466
OCCCAT	0.25984	0.34008E-01	7.641	0.00000	2.009
EXPF	0.20224E-01	0.46500E-02	4.349	0.00001	8.841
EXPNF	0.29869E-02	0.36784E-02	0.812	0.41678	6.157
MIG	-0.25479E-02	0.12208	-0.021	0.98335	0.2517
REMIT	-0.19144E-04	0.48564E-04	-0.394	0.69343	351.8
BMI	0.64928E-02	0.35455E-02	1.831	0.06706	18.75
HEIGHT	-0.79888E-03	0.70761E-03	-1.129	0.25890	135.0
MRTST	0.62943E-01	0.10586	0.595	0.55213	0.2958
FIRMSIZE	0.23006E-01	0.91547E-02	2.513	0.01197	4.380
LAMBDA	0.47751E-01	0.84543E-01	0.565	0.57220	1.201

Table - A.9

MARGINAL EFFECTS FROM THE HECKIT MODEL FOR WOMEN

Values 1- 19 are the direct effects ¤
¤ Values 20- 32 are the indirect effects ¤
¤ Values 33- 41 are the total effects ¤
à

Variable	Coefficient	Standard Error	z=b/s.e.	P[°Z°·z]	Mean of X
Constant	-1.2388	0.22629	-5.474	0.00000	
PRED	-0.31872E-02	0.25949E-01	-0.123	0.90225	3.956
SECED	0.82029E-01	0.26424E-01	3.104	0.00191	2.110
HIGED	0.44211	0.97225E-01	4.547	0.00001	0.8830E-01
EXPP	-0.27767E-01	0.10461E-01	-2.654	0.00794	15.67
EXPP2	0.25869E-03	0.20899E-03	1.238	0.21579	467.0
PATED	-0.17602E-01	0.16067E-01	-1.095	0.27330	1.267
MATED	0.72638E-01	0.25602E-01	2.837	0.00455	0.5099
FATHOCC	0.44689E-01	0.46515E-01	0.961	0.33669	1.141
MOTHOCC	0.79704E-01	0.62439E-01	1.277	0.20178	0.3466
OCCCAT	0.25984	0.34008E-01	7.641	0.00000	2.009
EXPF	0.20224E-01	0.46500E-02	4.349	0.00001	8.841
EXPNF	0.29869E-02	0.36784E-02	0.812	0.41678	6.157
MIG	-0.25479E-02	0.12208	-0.021	0.98335	0.2517
REMIT	-0.19144E-04	0.48564E-04	-0.394	0.69343	351.8
BMI	0.64928E-02	0.35455E-02	1.831	0.06706	18.75
HEIGHT	-0.79888E-03	0.70761E-03	-1.129	0.25890	135.0
MRTST	0.62943E-01	0.10586	0.595	0.55213	0.2958
FIRMSIZE	0.23006E-01	0.91547E-02	2.513	0.01197	4.380
Constant	0.57519E-01	0.11662	0.493	0.62186	
MRTST	0.33322E-02	0.61786E-01	0.054	0.95699	0.3066
YEARMIG	-0.59779E-02	0.81269E-02	-0.736	0.46200	1.192
MIG	-0.51081E-02	0.11690	-0.044	0.96515	0.5667E-01
PRED	-0.11502E-02	0.15695E-01	-0.073	0.94158	4.012
SECED	0.11600E-02	0.14712E-01	0.079	0.93715	2.235
HIGED	-0.45543E-03	0.56044E-01	-0.008	0.99352	0.9564E-01
PATED	0.94714E-03	0.91555E-02	0.103	0.91761	1.478
MATED	-0.86681E-03	0.16641E-01	-0.052	0.95846	0.3747
NOELDER	0.46224E-03	0.21738E-01	0.021	0.98303	0.3295
AGE	0.26616E-05	0.28348E-02	0.001	0.99925	30.19
MOTHOCC	-0.24925E-02	0.37289E-01	-0.067	0.94671	0.2912
FATHOCC	-0.35007E-02	0.29102E-01	-0.120	0.90425	1.023
PRED	-0.43374E-02	.....(Fixed Parameter).....			3.956
SECED	0.83189E-01	0.92547E-02	8.989	0.00000	2.110
HIGED	0.44166	.....(Fixed Parameter).....			0.8830E-01
PATED	-0.16655E-01	.....(Fixed Parameter).....			1.267
MATED	0.71771E-01	.....(Fixed Parameter).....			0.5099
FATHOCC	0.41188E-01	.....(Fixed Parameter).....			1.141
MOTHOCC	0.77212E-01	.....(Fixed Parameter).....			0.3466
MIG	-0.76560E-02	.....(Fixed Parameter).....			0.2517
MRTST	0.66275E-01	.....(Fixed Parameter).....			0.2958

Table - A.10

EARNING FUNCTION FOR WOMEN
(MLE ESTIMATES)

ML Estimates of Selection Model	
Maximum Likelihood Estimates	
Dependent variable	INCOME
Number of observations	3053
Iterations completed	36
Log likelihood function	-1318.232
LHS is CENSORED. Tobit Model fit by MLE.	

Variable	Coefficient	Standard Error	z=b/s.e.	P[°Z°·z]	Me
Constant	-0.95756	0.39436	-2.428	0.01518	
PRED	0.19242E-01	0.48196E-01	0.399	0.68972	
SECED	0.12151	0.40856E-01	2.974	0.00294	
HIGED	0.38376	0.14313	2.681	0.00734	
EXPP	-0.56534E-01	0.20094E-01	-2.813	0.00490	
EXPP2	0.56943E-03	0.44388E-03	1.283	0.19955	
PATED	-0.36184E-01	0.17935E-01	-2.018	0.04364	
MATED	0.64083E-01	0.28762E-01	2.228	0.02588	
FATHOCC	0.11254	0.69006E-01	1.631	0.10293	
MOTHOCC	0.13476	0.82232E-01	1.639	0.10125	
OCCCAT	0.22698	0.58975E-01	3.849	0.00012	
EXPF	0.12322E-01	0.71632E-02	1.720	0.08539	
EXPNF	-0.68270E-03	0.66733E-02	-0.102	0.91852	
MIG	-0.14378	0.19000	-0.757	0.44921	
REMIT	-0.29750E-04	0.94988E-04	-0.313	0.75413	
BMI	0.55943E-02	0.78105E-02	0.716	0.47383	
HEIGHT	-0.15056E-02	0.15955E-02	-0.944	0.34533	
MRTST	0.26210	0.20056	1.307	0.19125	
FIRMSIZE	0.85818E-02	0.10290E-01	0.834	0.40430	
Sigma(1)	0.93241	0.44992E-01	20.724	0.00000	
Rho(1,2)	-0.30131E-01	0.13912	-0.217	0.82853	

DECLARATION

I, the undersigned, declare that this thesis is my own work and has not been presented for a degree in any other university.

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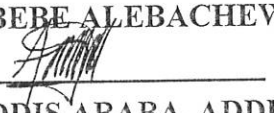
SIGNATURE	
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