EARNINGS DIFFERENTIALS AND RATES OF RETURN TO EDUCATION IN BOTSWANA

BY

HAPPY KUFIGWA SIPHAMBE

A Thesis
Submitted to the Faculty of Graduate Studies
in Partial Fulfilment of the Requirements
for the Degree of

DOCTOR OF PHILOSOPHY

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LIST OF ABBREVIATIONS

ADB	African Development Bank
COSC	Cambridge Overseas School Certificate (Upper secondary certificate)
CSO	Central Statistics Office
GDP	Gross Domestic Product
HIES	Household Income and Expenditure Survey
JC	Junior Certificate (Lower secondary certificate)
MFDP	Ministry of Finance and Development Planning
NDP	National Development Plan
NEMIC	National Employment Manpower and Incomes Council
SS	Supplementary Survey Data
UNDP	United Nations Development Programme
USAID	United States Agency for International Development
WPC	Wages Policy Committee

Note: Citizens of Botswana are Batswana; an individual citizen is a Motswana. The local currency is the Pula (equivalent to about US$0.33)

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ABSTRACT

Botswana experienced rapid growth since independence generated primarily from mineral exploitation. This enabled the country to pursue successfully human development as evidenced by human development indices. Despite this achievement, the country is challenged by a set of socio-economic problems that include: its inability to diversify the economy adequately from the diamond and beef, rising income inequalities, widespread poverty, and rising unemployment. A major challenge to the economy is that there is unlikely to be any major growth in government revenues in the future, and yet there will be a need to finance the growing expenditures. This implies that government will, in future, need to curtail its expenditures on various aspects of the economy. The funding of education is a major cost, which will have to be evaluated.

The major aim of this thesis is to calculate private and social rates of return to education in Botswana. We also test the empirical usefulness of the human capital model in the Botswana economy and finally, contribute knowledge to an understanding of the functioning of Botswana's labour market. The main tool of analysis is the Mincerian earnings function and the elaborate method. We use two data sets, one from a household income and expenditure survey and a supplementary survey conducted by the author.

The major results are: 1) rates of return rise by level of education; 2) the highest distortion between private and social returns is at tertiary level and the lowest is for primary education; 3) education is not income equalizing; 4) women are paid less than men and yet they are on average more educated than men; 5) returns to education are higher in the public sector than in the private sector, supporting a screening role of

education hypotheses; and 6) the empirical fitness of the human capital model is quite robust, even though the results show some role of screening.

The policy implications include: there is room for private financing at the upper secondary and tertiary levels of education; employment creation has to be pursued vigorously; and there is a need to address equity and gender inequality issues.

CHAPTER ONE

INTRODUCTION

1.1 Economic Growth

The impressive performance that Botswana has achieved since gaining independence in 1966 is one of the few success stories of economic development in sub-Saharan Africa. For much of the last 25 years Botswana has been the fastest growing economy in the world with an average real growth rate of 13%, and this has enabled the country to move from position of severe poverty to being one of the richest in the region, and is one of the few in sub-Saharan Africa now classified as a middle income country. Much of this success is attributable to the exploitation of major diamond deposits discovered one year after independence. Nevertheless, important aspects of Botswana's political economy - including political pluralism and sound economic management - have been singled out as major factors to this success story. This success story has also been evidenced by the good performance in terms of human development indicators, showing that some part of these resources have been transformed successfully into human development. This is shown clearly by increasing life expectancy, high literacy rates, low mortality rates, etc. Education was one important human development aspect that received a tremendous attention from the government.

Despite the country's impressive performance in terms of both output growth and increased expenditures towards education and other basic needs, the economy is challenged by a set of socio-economic problems, which threaten the country's progress. Some of the major problems are: its inability to diversify the economy adequately from diamonds and beef; rising income inequality, especially cash incomes; absolute poverty

of a major part of its population, especially in the rural areas; and rising unemployment especially in the urban centres. Unemployment is especially rampant among the youth who have completed only primary and junior certificate levels of education. Most graduates of the university were mainly being employed by the government sector, but government has come to realise that it can no longer absorb all of them. In the past, graduates were allocated to jobs even before completing their final year exams. This picture has changed in the last three years.

1.2 *The emerging financial problem*

Towards the end of National Development Plan 7 (NDP 7) there was an indication of an important and different problem to the Botswana economy. There was an indication that the boom period that the economy went through in the past periods is quickly coming to an end. The major factors to the anticipated fall were mainly the uncertain market for the two major commodities of beef and diamonds, which were the major driving force to the impressive growth in the past. In 1994/95, for instance, there was an economic slowdown in the economy, due partly to the levelling off of the diamond boom. The projections by then were that the future economic growth would be much lower than the levels to which Batswana have become accustomed. For the remainder of the National Development Plan 7 period, real GDP was expected to grow at an average rate of 4.6% per annum. The real GDP growth rate in 1994/96 was 3.1%, and it doubled to 7% in 1995/96 (Republic of Botswana, 1997a). The improvement was mainly due to a significant recovery in the mining sector.

Given this low anticipated growth rate in real GDP towards the end of NDP 7, the government budget was forecast to run into increasingly large deficits from 1996 onwards (Republic of Botswana, 1991d). However, no budget deficits were incurred up to the present moment. The first major factor that changed the 1995/96 government

budget from an anticipated deficit of P270 million to a surplus of P269.9 million was the depreciation of the local currency. The depreciation of the Pula currency has the result of boosting major revenue sources when measured in local currency terms. A second factor was the underspending of the authorised development budget, a problem that has affected the public sector for several years (Republic of Botswana, 1997a). The new projections for NDP 8 indicate that government is likely to be faced with abundant financial resources derived mainly from the mineral revenue. A major factor is the intended expansion of the Orapa mine to double its capacity by the year 2000. The 1997/98 budget is forecast to run into a surplus of P763 Million (Republic of Botswana, 1997a; Bank of Botswana, 1996). The surplus however is mainly on account of the depreciation of the local currency, vis-à-vis the major currencies of which our exports are denominated. The Minister of Finance emphasised that "*this is not a reflection of increased revenue performance per se*" (Republic of Botswana, 1997a: 20).

What we need to remind ourselves, however, is that diamonds are a non-renewable resource. A more rapid rate of diamond extraction does not itself increase the nation's wealth, for what is mined today cannot be mined tomorrow. The fact of the matter is that Botswana has a very narrow revenue base and it is vulnerable to drought and external events. Such a situation puts Botswana's long term sustainability on a very precarious position. Given the high dependence on mineral revenue, the economy is likely to run into serious financial problems if either diamonds are depleted or their market does not do very well. A major issue mentioned in NDP 8 is that after the Orapa mine expansion, it is unlikely that any significant strong growth in the diamond sector will continue. Since government receives more than half of its revenues from the mining sector, government expenditure growth will have to be restrained in order to make the budget sustainable (Republic of Botswana, 1997b: 89)

The implication of the changing situation is that the government will, in future, need to curtail its expenditures on various aspects of the economy. There will therefore

be a pressing need to prioritise in terms of government expenditures from the falling revenues. Moreover, as the Bank of Botswana (1996) rightly put it, more revenue does not itself alter the cost benefit analysis that should underlie investment projects, including investments in education. An estimation of rates of return for different levels and types of education will therefore be useful as a guide to the Botswana Government in setting its priorities as to what education to promote, how students are to be allocated among the types of education available, and how the various education programs should be funded.

The second implication of the future budget constraints is that the government's ability to deal with the aforementioned problems of income inequality, poverty, and unemployment, especially as more youths and graduates become unemployed, will be limited. These problems will definitely have an impact on the kind of education policy to be followed. There will be a need to prioritise in terms of different levels of education as the budget constraint becomes more tighter and labour market conditions change. The choices to be made will be whether to emphasise primary, secondary or higher education and how to allocate students between those education levels. Or still whether to promote vocational or general types of education. Also important will be to find a suitable role for education in helping to deal with widening earnings differentials, that could in the long run threaten the stability of the economy. The question to be established is the role of increases in educational opportunities in reducing educational inequalities and income inequalities. Given that earnings and general incomes are generally unequal, government will need to promote schooling programs that promote equity. The form of funding such education programs is an important aspect of addressing the equity issue. Therefore an understanding of how funding the different types and levels of education affects equity is an important research issue for sound education policies in contemporary Botswana.

1.3 *Aims and Objectives of the Research*

The main aim of this research is to estimate private and social rates of return to different types of education in Botswana. Private rates of return indicate the individual's demand for that level of education, while social rates are useful as a guide to resource allocation from the government and society's point of view. Even though education is made for important purposes other than just being an investment, for which the purpose is to enhance the future earnings of the graduate, the hope is that these estimated rates of return will be used to justify emphasis on different types of education as the economy moves into the lean years.

The earnings profiles from this study will also serve to show the earnings differentials and what explains those earnings differentials in Botswana's labour markets. In particular, the study tests the empirical fitness of the human capital model in explaining earnings differentials in a less developed country. This will also bring out the implications for education's role to earnings inequality, i.e. whether education expansion would exacerbate earnings inequality or not, and furthermore, which type can best and efficiently address the inequality problem.

Labour market conditions are also brought into the analysis by estimating and comparing the rates of return between the public sector and private sector, formal and informal sector, and between male and female workers.

This is an empirical study whose objectives are;

1) to test the human capital model in the Botswana economy;

2) to generate results that should be useful for education policy in Botswana relating to efficient allocation of resources between the different levels of education and how funding and access to different levels affects equity;

3) to contribute knowledge to an understanding of the functioning of Botswana's labour market.

1.4 *The Structure of the Study*

Chapter two summarises the changes in education in Botswana in terms of both enrolment and changes in expenditures from the independence years. We also deal with the evolution of the education system up to its present status.

Chapter three describes the theoretical model that is used in the study. We also discuss in this chapter the methodology, including a set of testable hypotheses, and the sources of data for the study. Chapter four discusses the labour market in Botswana using two sets of data, one set from the 1993/94 Household Income and Expenditure Survey (HIES), and another data set from a supplementary survey to HIES conducted by the author in late 1996. Chapter five gives a summary of the literature on rates of return to education in Africa. Chapter six summarises private and social rates of return to education from Botswana from the two data sets. This is done by gender, type of organisation, formal versus informal sector, location of workers, etc. Chapter seven summarises some tests for the screening hypothesis from the two data sets. Chapter eight summarises the policy implications of the study for educational development. Chapter nine summarises the conclusions of the study.

CHAPTER TWO

THE POLITICAL ECONOMY OF EDUCATION IN BOTSWANA

2.1 *Introduction*

The first section in this chapter traces the development of education in terms of both enrolment and changes in education expenditures since independence. The second section summarises the education structure and traces the evolution of the structure.

2.2 *Education -Changes in Schooling Enrolment and Expenditures*

Lack of skilled and educated Batswana was one of the most important constraint on development at independence and many years afterwards. At independence, there were few schools and educated Batswana as a result of the neglect of education by the colonial government. The few schools that existed were a result of local and missionary initiatives. At independence, Botswana is believed to have had 40 Batswana who were university graduates and about 100 with senior secondary certificate. Most of the university graduates were trained outside the country, mainly in the Republic of South Africa (Harvey and Lewis, 1990). Botswana was however not exceptional in terms of neglect of education by the colonial government. With a population eight times that of Botswana, Zambia, for instance, had only twice as many university graduates at independence, even though it had ten times as many secondary school graduates as Botswana (Harvey and Lewis, 1990). Given the small human capital inherited from the colonial government, the Botswana government had to invest heavily in education, but there were still severe shortages mainly due to long time lags inherent in education and the rapid economic growth which in turn increased the demand for educated people (Harvey and Lewis, 1990). Most of these critical manpower shortages were being met by heavy importation of skilled labour, which was very expensive for the Botswana

government. Just two years prior to its independence, only 24 of the 184 administrative posts were held by Batswana; even at lower levels, only 275 out of 623 posts in the technical, executive and secretarial grades were held by Batswana (Colclough and McCarthy, 1980).

School enrolment for all levels increased considerably since independence, as a response to this manpower constraint. In 1975 58% of the primary schooling going age were enrolled, while that percentage had increased to 91% by 1991. Percentage of age group enrolled in secondary education also increased remarkably from 7% in 1970 to 54 % in 1991. Post secondary (tertiary) enrolment increased slightly from 1% in 1970 to 3% in 1991 (World Bank, 1994: 217-217). Compared to most countries, for which data are available, the increase in enrolment in secondary education between 1970 and 1991 for Botswana was exceptional. South Africa increased its enrolment from 30% to 54% over the same period, Zimbabwe, 4% to 13%, Lesotho 7% to 25% (World Bank, 1994: 216-217). Between 1978 and 1990 enrolment had increased for all levels of schooling, with secondary enrolment having achieved the greatest change in enrolment of 254%. Enrolment for all levels increased by approximately 112% between the period 1978 to 1990 (see table 2.1 below). The guiding principle to education expansion was provided by a manpower plan.

Table 2.1 *Percentage Change in Schooling Enrolment 1978-90*

Enrolment	1978	1990	% Change
Primary	145, 459	283, 516	95
Secondary	16, 086	56, 892	254
All Levels	164, 566	348, 648	112

Source: Education Statistics 1990, CSO, Botswana

Despite the remarkable achievements in terms of enrolment, the mean year of schooling was only 2.5 for the year 1992. Compared with other countries in the region,

the figure is a little bit too low. Zimbabwe had mean years of schooling of 3.1, Lesotho, 3.5, Zambia, 2.7, South Africa, 3.9. The mean was only higher than Malawi (1.7) and Mozambique (1.6) (UNDP, 1994: 130-131).

Expenditure on education, both recurrent and development expenditures increased from 15.8% in 1982 to 16.5% in 1986, and to 18.3% of total expenditures in 1993. The recurrent expenditures fell slightly from a share of 21% in 1982 through the years 1983, 1984, 1985 and 1986 and started increasing again thereafter reaching a percentage of 22% of total recurrent expenditures in 1993. Development expenditure fluctuated more as it increased to 12% in 1993 from 9 % of total development expenditures in 1982 (see table below).

Table 2.2 *Changes in Education Expenditures as a percentage of Total Expenditures*

Ed. Exp.	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991	1992	1993
Total Exp.	15.8	16.6	14.9	15.7	16.5	16.2	16.5	17.1	16.5	15.3	17.3	18.3
Recurrent e	21.4	21.1	20.8	20.6	19.5	20.3	20.9	20.5	22.4	22.2	22.8	22.3
Dev. Exp.	9.1	10.1	7.4	8.4	12.4	11.5	12	13.4	10.9	10.4	9	11.6

Source: CSO, "Statistical Bulletin", December 1993 & March 1994, Vol. 18 No.4, pp 26-31

Most of these expenditures were being absorbed by university education and secondary education. Primary education share of the budget was projected to fall from 40% in 1984/85 to 30% in 1990/91, while that of university and secondary education was to rise from 19% to 23% and 34% to 39% respectively over the same period. Technical education's share was to fall from 3% to 2% in the same period (Republic of Botswana, 1985). During 1991 to 1997 the share going to primary education will further decrease to 18%, that going to secondary will remain at 39%, while the university share will fall to 18%. A notable increase is the share of technical education, which should absorb 17% share of the budget compared to about 3% that it had in the previous plan period (Republic of Botswana, 1991d). This reflects government recognition of this type of

education, given that products of such institutions are believed to be more suitable for self-employment.

During the late 1970's the government began to be increasingly aware of the equity issues of education as evidence was clearly showing that a number of students were unable to complete some levels of education due to financial constraints. In line with the goal of universal education for all, the government abolished school fees, first at primary school (1978) and later for secondary school in 1989. Despite being free, its quite clear that there are still some "missing children" due to some hidden costs of schooling, for example, uniforms, opportunity cost of child labour especially for the poor, etc.

University education was paid for by the government via a bursary scholarship that provides that the graduate will contribute 5% of initial gross salary for each year of sponsorship. Apart from the fact that this contribution does not cover the full costs of training, a more serious problem has been that a majority of the graduates were not contributing since the co-ordination between the employers and bursaries department has been poor, making it difficult to find out who is contributing or even to trace graduates (Republic of Botswana, 1991d). To alleviate this situation NDP7 proposed to proceed consciously to implement a cost recovery through a loan/ grant scheme, which will be provided to any Motswana who qualifies to go to university. Primary and secondary education will continue to be free.

2.3 *The Structure of Botswana's Education System and Its Evolution*

Prior to 1988 the education structure in Botswana was 7 years of primary + three years of junior secondary + two years upper secondary + four years university education. This structure was introduced in 1963/64. The first National Commission on Education

was appointed in 1977. This report became the guiding document for the direction of education policy until 1993, when a second commission was appointed.

One of the major changes introduced by the first commission (1977) was a restructuring of primary and secondary education. They proposed a structure of 6 years primary + three years lower secondary + three years upper secondary + 4 years university. A transitional structure of 7 + 2 + 3 + 4 was proposed by the 1977 commission. This system was introduced in the education system in 1988. Along with the changes in the structure were also some fundamental changes in both content and progression rates. 95% of the primary school leavers got places in junior secondary schools compared to 35% in 1977. In general, there was a move from a selective system to a massive programme of junior secondary. In line with basic education being a basic 'human right', provision of universal access to nine years of basic education was guaranteed to every Motswana child. The government had to embark on a programme of expanding junior secondary education both in terms of facilities and enrolment (Republic of Botswana, 1993).

The 1993 Education Commission recommended a re-introduction of the 7 +3 + 2 + 4 system. The major reasons for proposing the return to this structure were; two years of junior secondary was regarded as too short to adequately prepare student for further education and especially for the labour market; the envisaged change to the 6 + 3 + 3 + 4 structure poses organisational, financial and educational problems; the two year programme is not accepted by employers and training institutions as equivalent to the former three year programme; the first year of senior secondary (form 3) was widely

regarded as a wasted year in terms of academic progress, etc.(Republic of Botswana, 1993).

The 1993 Commission's recommendation to revert the structure to that operating prior to 1988 was widely accepted and started to be put in effect in January 1996. The education system in Botswana is operating on the 7 + 3 + 2 +4 structure. The minimum age for entry into Standard one is 6 years. Three years is the acceptable age for entering pre-school. Students normally complete 3 year junior certificate at the age of 16, which is considered a mature age for entry into the labour market if one does not qualify to proceed. Universal access to basic education (now 10 years) is still a major goal of government. The government also aims to increase pre-schools and vocational education.

CHAPTER THREE

THE MODEL/ SOURCES OF DATA

3.1 Introduction

The main purpose of this chapter is to discuss the human capital model including its limitations and the sources of data. The first section traces the development of the human capital concept. The second section deals with the relationship between human capital and earnings. We then trace the theoretical development of the human capital model in the third section. The fourth section discusses a major tool of the human capital model known as an earnings function. We then discuss some empirical results from the use of various Mincerian earnings functions. The next section deals with the methodology and data to be used in this study. In the last section we discuss the main limitations of the study.

3.2 Development of The Human Capital Concept

The idea that acquisition and development of skills through education and on-the job training are a form of investment has been in the literature for some years. Schultz (1961) argues that economists have long known that people are an important part of the wealth of nations, but what they have avoided stressing is that people invest in themselves and that these investments are very large. He mentions Adam Smith and Irving Fisher as two economists that had an all inclusive concept of capital in the sense of it being also applied to human beings. Kiker (1971) includes within the list Petty, Senior, Say, and Walras, among others. According to Rosen (1980), the idea of human capital did not come into the forefront of the profession until the late 1950's and early 1960'with

empirical results of Schultz (1961, 1971), Denison (1962) and others showing the importance of education for productivity growth in the United States Economy. The concept of human capital has since then become an important concept in fields such as development economics, labour economics and health economics. It has also given birth to a new branch of economic theory and investigation known as the economics of education.

Since its inception, there has been a tremendous growth of research and publications in the area of economics of education. According to Woodhall (1987a) this research includes such topics as the contribution of education to economic growth, the profitability of investment in education, the costs of education, education financing, effects of education on income and wealth distribution. The concept of human capital is central to much of the research in the economics of education. It has also had a powerful influence on the analysis of labour markets, wage determination, expenditures on health care and the study of migration.

3.3 Human *Capital and Earnings*

Since the advent of the human capital concept, much attention has been devoted to the relationship between income and schooling. The earliest explanations of the concept of human capital suggested that education or training raised the productivity of workers, and hence increased their lifetime earnings (Woodhall, 1987b). Education was, from the point of view of the human capital school, a way of imparting knowledge and useful skills that made the worker more productive. The earnings of workers with more education were, therefore, justifiably more than those with less education because they

were more productive than the less educated workers. This is the basis of viewing education as an a form of investment in human capital, that is, education raises the productivity of workers and that higher earnings of the educated reflect the value of their marginal productivity.

Woodhall argues that if this basis is accepted, then the relationship between earnings and education has two major implications. First, since educated workers earn more than the uneducated ones, their earnings can be used to measure their contribution to growth of national income over time. Second, if it is accepted that relative earnings reflect productivity differences, earnings differentials can be used as a measure of the economic benefits to education in calculations of social returns to investment in education (Woodhall, 1987b: 216). Thus using differences in market earnings among individuals with different schooling has become an acceptable way of measuring the benefits of education in most empirical studies employing human capital models.

The view that education is a form of investment in oneself for future benefits measured by an enhanced earnings has been challenged from several angles. Solmon (1987) argues that observers of education must remind themselves that monetary benefits are only one type, and perhaps not the most important type, to be considered in the total evaluation of the value of education. There is a consumption aspect of education, which is usually not easy to separate from the investment part. Moreover there are numerous psychological, behavioural, and other impacts of schooling that are difficult to identify and measure. Based on a research on peasants in Uganda, Marvin brings out an important point about benefits of education when he concludes that:

" The characterisation of African parents as being interested in schooling as a means to attain the maximum financial gain is a crude over-simplification which has not been adequately proved to exist...if a child wants to work in the city and is able to find a formal salaried position, a father will be pleased. On the other hand, if a school leaver should turn to agriculture or the informal sector to earn his living, the father is not necessarily disillusioned, nor does he feel he wasted his money" (Marvin, R, 1975: 444-445). An important benefit to women is in the form of lower fertility, better nutrition, health and education of educated women's children. The problem, however, is that most of the other benefits of education are difficult to quantify and thus the persistence use of market earnings in most calculations of benefits to education.

3.4 *Theoretical and Empirical Development of Human Capital Models*

The theoretical and empirical development of the human capital model is usually associated with Jacob Mincer, Garry Becker, and Ben-Porath among others. Mincer (1958, 1974) forms the basis for most theoretical and empirical models. In contrast to models that emphasise chance as a major determinant of earnings differentials, his model is cast in a rational choice in which the differentials are a compensation for various advantages and disadvantages of receiving those incomes. To simplify Mincer begins with a model that assumes that: (1) all individuals have identical abilities and equal opportunities to enter any occupation; (2) occupations differ in the amount of training they require; (3) flow of earnings is constant throughout the working life; (4) zero depreciation both during schooling and during working life; (5) postponement of earnings due to training is tantamount to a reduction of the earning span; (6) the cost of

training are only the forgone earnings (Mincer, 1958: 258, 1974: 8-9). With these assumptions then he proceeds to show the effects of schooling on earnings. Denoting:

Vn= Present value of an individual lifetime earnings at the start of training

Yn= annual earnings of an individual with n years of training

r= discount rate (interest rate)

t= 0,1,2,.....,l time, in years

d= difference in the amount of training, in years

l= length of working life plus length of training

e= base of natural logarithms.

Then $Vn = Yn \sum_{t=n+1}^{l} (\frac{1}{1+r})^t$,

When discounting process is discrete and the process is continuous:

Vn= $Yn\int_n^l (e^{-rt})dt = \frac{Yn}{r}(e^{-rn} - e^{-rl})$. Similarly, the present value of life-earnings of individuals with (n-d) years of training is:

Vn-d = $\frac{Yn-d}{r}(e^{-r(n-d)} - e^{-rl})$, and solving for the ratio kn, n-d from equalising present values Vn=Vn-d we get:

$$Kn, n\text{-}d = \frac{Yn}{Yn-d} = \frac{e^{-r(n-d)} - e^{-rl}}{e^{-rn} - e^{-rl}} = \frac{e^{r(l+d-n)} - 1}{e^{r(l-n)} - 1} \qquad (1)$$

From equation (1) the following conclusions can be drawn; (a) Kn, n-d, is larger than one, implying that people with more training have higher annual pay; (b) Kn, n-d, is a positive function of r, implying that the difference between earnings of individuals differing by d years of training is larger the higher the rate at which future income is

discounted; and (c) Kn, n-d, is a negative function of l, implying that the difference between earnings of individuals is larger the shorter the general span of working life. That is to say that the difference between a person with d amount of training and one without has to be larger if a person has to invest in training whose benefits have to be recouped in a short time. For someone approaching retirement for instance, they would need a big difference between their present pay and pay with training if they are to be induced to invest in training at that age (Mincer, 1958: 285). The general conclusion from this model is that the more skills and experience are acquired over time, earnings rise, but in later years ageing often brings about a deterioration of productivity and hence a decline in earnings. Mincer concludes that "*differences in training result in differences in levels of earnings among occupations as well as differences in slopes of life-paths of earnings among occupations*" (Mincer, 1958: 288).

Becker and Chiswick (1966) present the idea of human capital in demand and supply. The individual demand curve is derived from a schedule of marginal rates of return, or increments of investment in human capital and is downward sloping. The supply curve shows the marginal costs in terms of rising interest payments and is upward sloping. The intersection of the two curves determines the equilibrium level of investment. If demand were greater than supply, then the marginal rate of return would exceed the marginal rate of interest, and income would be increased by additional investment. Investors have different demand curves for human capital because they differ in such characteristics as ability. The more able have a demand curve that is to the right of that of the less able. Investors also have different supply curves because of differences in economic circumstances. People from rich families have more access to

funds and thus apply a lower rate of discount to their forgone time for investing: thus their supply curve is to the right of those from poorer families.

Using this model we can for instance address questions like equality of opportunity. By the Becker - Chiswick model, this is equivalent to making the supply curve for human capital identical for all investors, i.e., giving everyone an equal opportunity to invest. This only leaves the demand side as the determinant of earnings differentials. The problem however is that, some of the demand determinants, like ability, may still be highly positively correlated with level of wealth, such that equality of opportunity is unfairly extended to those who are not entitled to a subsidy. If the aim was to equalise lifetime earnings and improve general income distribution, it is not surprising that income differentials and general income distribution might remain the same or even worsen defeating the whole purpose of equalising lifetime incomes.

The idea of optimal human capital production is well developed in Ben-Porath (1967) and Becker (1967). Mincer (1958, 1962) observed that people make most of their investments when they are young and that observed earnings are relatively low at early ages and rise as investment declines. Ben-Porath provides an answer by combining the arguments concerning the demand for education with a more explicit treatment of the supply, or cost conditions, facing the individual (Ben-Porath, 1967). Ben-Porath assumes that in every year of one's life they invest in themselves in accordance with costs and benefits of investment at that stage of the life cycle. Individuals are thought of to behave the same way as firms. The benefits are in the form of present value of extra wages obtainable from the incremental unit of investment. To introduce the cost side he introduces a human capital production function. The output (Q) =f (K, T, R), where K

denotes previously accumulated human capital, T is time, and R is other market resources (Mincer, 1974). The marginal cost curve is assumed to be upward sloping on the basis that the production function is subject to diminishing returns. He ignores leisure in his analysis and also assumes that the stock of human capital is homogeneous and subject to an exogenously given rate of depreciation, δ. He postulates a human capital production function in the form:

$Qt = \beta_0(StKt)^{\beta 1}Dt^{\beta 2}$, where β_1, $\beta_2 > 0$, and where Qt is the flow of human capital produced; D is the quantity of purchased inputs (Ben-Porath, 1967). Following Polacheck and Siebert (1993) let us denote Et as the most that individual aged t could earn if all available time was spent working (earnings capacity). This would be equal to the amount of human capital accumulated in the past (Kt) multiplied by the wage rate per unit of human capital (w), i.e., wKt. Let us further assume that the human capital production function is a Cobb-Douglas type: $Qt = (StKt)^{b.}$ [1], where St is the proportion of human capital Kt diverted from earnings, i.e., used for further production of human capital; $0<St<1$; b is the ability parameter; $0<b<1$. Further suppose that the costs of investment are only the forgone earnings: $Ct = wStKt$.

The benefits $Bt = PV(w, i)\, Qt$, which is the present value of the stream of future wages that the extra unit of investment will bring. Assuming the individual retires at age 65 then these benefits are:

$$Bt = \frac{wQt}{1+i} + \frac{wQt}{(1+i)^2} + \ldots \frac{wQt}{(1+i)^{65-t}} = \frac{wQt}{i}\left(1 - \frac{1}{(1+i)^{65-t}}\right) \qquad (1)$$

[1] The quantity of purchased inputs (Dt) and depreciation rate are omitted here to make the solution simple.

The marginal benefit= $\partial Bt \backslash \partial Qt = \frac{w}{i}(1-\frac{1}{(1+i)^{65-t}})$ (2)

Since $Ct = wStKt$ and $Qt = (StKt)^b$ then $StKt = Qt^{\frac{1}{b}}$; $Ct = wQt^{\frac{1}{b}}$ (3)

Marginal Cost= $\partial Ct/\partial Qt = (\frac{w}{b})Qt^{\frac{1}{b}-1} = (\frac{w}{b})Qt^{\frac{1-b}{b}}$ (4)

Equating (2) and (4) and solving for Qt:

$\frac{w}{i}(1-\frac{1}{(1+i)^{65-t}}) = (\frac{w}{b})Qt^{\frac{1-b}{b}}$ and:

$\frac{b}{i}[1-\frac{1}{(1+i)^{65-t}}] = Qt^{\frac{1-b}{b}}$

$Qt = [\frac{b}{i}(1-\frac{1}{(1+i)^{65-t}})]^{\frac{b}{1-b}}$ (5)

There are three relationships that we can bring out from equation (5). First, a higher b is associated with higher human capital production (Qt) and therefore higher earnings. This implies that more able people do invest more in themselves than the less able ones; the reasoning being that more able people do face lower marginal costs to human capital production (Mincer, 1974). Secondly, there is an inverse relationship between the discount rate (i) and human capital accumulation (Qt). Individuals facing higher discount rates will invest less, accumulate less capital, and consequently have lower growth in earnings over their lives. Polacheck and Siebert (1993) argue that people who face high discount rates are likely to be the poor. This they argue, is the equity basis for subsidising education. Lastly, there is an inverse relationship between t or age and human capital (Qt). The lower t is, the higher the human capital accumulation; that is younger people do invest in themselves more than older ones do.

This is because as one gets old, the time period for reaping the benefits of human capital investment becomes shorter; and hence they face a lower marginal revenue/benefit. As one ages, the marginal revenue continuously decrease until it is zero at retirement age, where it is assumed that the individual stops investing at all. By setting $t = 65$, $Qt = 0$, implying that individuals do not invest in themselves after retirement. Mincer points out that generally "*the higher the marginal revenue curve and the lower the marginal cost curve, the larger the investment in human capital in any given period*" (Mincer, 1974: 15).

Weizsacher (1993) provides a more rigorous life-cycle model of individual earnings that extends Ben-Porath's work by providing an explicit structural approach that permits explicit treatment of certain human capital variables. The life-cycle model assumes the form of a control problem, which can then be solved for optimum values. This also allows for a comparative analysis of optimum values. The model is based on the following assumptions: (1) labour supply is omitted in the analysis - this implies that the time spent in the labour market is fixed and constant for all working periods; (2) an individual's human capital stock reflects the individual's productive economic skills, talents and knowledge; (3) human capital does not affect the utility associated with any given consumption plan - intangible benefits of accumulating human capital are accordingly ignored; (4) there is a perfect capital market for human capital investment - this allows for availability of unrestricted funds for lending and borrowing at a constant rate of interest; (5) the prices in the model (human capital price or wage R, educational goods price or tuition and book fees, P and interest rate) are constant, exogenous, market determined factor prices, i.e., individuals act as price takers in all markets; (6)

individuals have perfect knowledge about themselves and are risk neutral (Weizsacker, 1993: 25-29).

The description of the individual's formation of income is as follows: at the beginning of his working life, the individual has an initial human capital stock = Ko (>0). Given the wage rate R, the earnings of the individual in the initial period are RKo. The individual can increase his stock of human capital in two ways: by reinvestment of their stock and by buying educational markets goods. Representing the stock of human capital diverted away for investment in period zero by s_0, then the earnings realised in period zero amount to R (Ko- s_oKo) = RKo (1-s_o) [>0]. If direct education costs are PDo, where P is their price and D is their quantity, then disposable earnings in period zero are RKo(1-s_o)- PDo≡Ao. In general for all periods then:

$A_n \equiv RK_n (1-s_n)- PD_n$, $Sn \in [0,1]$, $D_n \in [0,\infty]$, R>0, P>0; n=0...N.

To describe how the individual capital stock changes over time Weizsacker then introduces an internalised human capital production function similar to one introduced by Ben-Porath (1967). This is the form $Q_n = b_o (s_nK_n)^{b1} D_n^{b2}$; with the usual assumptions that $b_1 + b_2 < 1$ implying diminishing returns to scale in human capital production; b_1 and b_2 give the production elasticities of the factors s_nK_n and D_n respectively; b_0 is a factor-neutral parameter of production efficiency - it reflects the ability of the individual to increase their productive capacity. It is determined by a number of factors summarised as follows: bo =b_o[LA (G,HO,CU);DF(HO,CU);QPC(a,b,c,);CR;SQ]; LA denotes learning ability, which in turn depends on genetic factors (G), cultural influences (CU), family background (HO). DF denotes the Lydall's D-factors such as motivation, ambition, self-discipline, will power, etc. These are non-cognitive factors, which are

influenced by family background, and cultural factors. QPC denotes other personality traits such as leadership qualities and organisational abilities, which depend on factors such as ability to take risks and ability to assume responsibility. CR denotes class rank variables, for example grades, while SQ denotes school quality. The partials for all the five groups of determinants are expected to be positive; i.e. $\partial b_o/\partial LA>0$, $\partial bo/\partial DF>0$, etc. (Wiezsacker, 1993: 32-37).

In contrast with Ben-Porath, Weizsacker includes an implicit human capital production function to take account of the fact that human capital profits from learning by doing phenomena. This is done by including an expression $c(1-s_n)K_n$, $c>0$. The proportionality to K_n reflects the idea that the higher the human capital, the better equipped one is to learn from experience. An accumulation equation for human capital stock is therefore summarised as follows:

$K_{n+1} = K_n + Q_n + c(1-s_n)K_n - \delta K_n$, $n=0,...,N-1$, $Ko>0$; where δ is the depreciation rate reflecting ageing, failing mental agility, etc.

The individual's objective function is to choose s_n and D_n given the above constraint so as to maximise the present value of disposable income $V: = \sum_{n=0}^{N} A_n(1+r)^{-n}$.

This problem takes the form of a control problem, which can be summarised as:

$$\underset{\{s_n \in [0,1], D_n \in [0,\infty]\}}{Max} V = \sum_{n=o}^{N-1} L_n(K_n; s_n, D_n) + L_N(K_N), \text{ under the constraint that:}$$

$K_{n+1} = g(Kn; s_n, D_n)$, $n=0,...,N-1:$; given $Ko>0$. Where $Ln(Kn; s_n, D_n): = A_n(1+r)^{-n}$,

$n= 0,...,N-1:$

$L_n(K_n):=A_n(1+r)^{-N}= RK_N(1+r)^{-N}$

$g(K_n:s_n,D_n) := b_o(s_nK_n)^{b1} D_n^{b2} + [1+c(1-s_n)-\delta] K_n$. The solution to this problem requires the definition of a sequence of H_n such that $\partial H_n/\partial s_n = 0$, $\partial H_n/\partial D_n = o$; n= 0...N-1. This then solves for optimum values Sn^* and D_n^* from the stationary conditions above (Weizsacker, 1993: 40-52).

The above model was based on an assumption of an exogenously given Ko. But part of the initial Ko would have been generated endogenously from education before entry into the working life. To complete the model Weizsacker therefore incorporates the education decision that occurs before entry into the market. By backward induction Ko= Ko(S) to make the optimal disposable earnings a function of S, with $s \in [0,\infty]$; dKo/ dS>0. The objective then is to find the S that will create the best of all trajectories for the individual. The control problem in the previous section gives the value $V^* = \sum_{n=0}^{N} A_n^*(S)(1+r)^{-n} = V^*(S)$. The task becomes maximising this value with respect to S, discounted to the time of the choice of S. Ignoring the direct costs of schooling, the maximisation problem becomes: $\underset{s\in[0,\infty]}{MaxW} = V^*(S)(1+r)^{-s}$, where W is the value of future disposable earnings. To obtain the optimum length of basic education we require that dW/dS =0: obtaining $dV^*/dS\ (S^*) = \ln(1+r)V^*(S^*)$. In other words, the period of full time schooling is extended until the marginal gain of increase in S, dV^*/dS equals opportunity costs $\ln(1+r)V^*$ from the delayed start of income flow (Weizsacker, 1993: 53-57). In order to find a solution for this model the function of Ko(S) is specified as $Ko(S) = a_0 + a_1S$; $a_o>0$, $a_1>0$; $S \in [0,\infty]$. a_0 represents the stock of human capital at the beginning of the planning period; and its a function of genetical inheritances (G), home environment (HO) and cultural environment (CU). a_1 is the parameter for production efficiency like b_o in

the production function of the previous section. It represents the individual's learning efficiency during the full time schooling phase; $a_1 = a_1[LA(G,HO,CU); DF(HO,CU)$, and like b_o the partials are greater than zero, i.e. $\partial a_1/\partial LA > 0$, $\partial a_1/\partial DF > 0$ (Weizsacker, 1993: 53-60). The problem can then be solved for the optimum amount of full time schooling S^* The model produces the following factors that determine earnings differentials: prices R, P, r; structural parameter c,δ, b1, b2 and production efficiency parameters a_1 and b_0. The advantage of this model is that it brings out explicitly some of the determinants of earnings differentials like home environment and cultural factors into the model, in other words it has more structure than most human capital models and yet arrives at a closed solution for the optimum values. Macroeconomic aspects such as economic growth, inflation, unemployment, can for instance be added easily with a specification R(.), P(.), and r(.).

The theoretical link between human capital and lifetime earnings is summarised in the form of an earnings profile. Earnings are seen as a return to training (both schooling and on-the job). Since human capital grows over the life cycle by means of investment and declines by means of depreciation and obsolescence, earnings change accordingly. An average earnings profile shows rapid growth during the first decade of working life, lesser growth subsequently, and levelling in the third and fourth decades (Mincer, 1980: 106-107). Why do earnings grow over the life cycle in a decelerating fashion? Mincer puts the answer in the following words: "*the life cycle growth of earnings reflects the rate of accumulation in personal investments. This self-investment can be analysed as an optimisation decision of an individual... the investment may increase initially, but continue at a diminishing rate through the rest of the working life*"

(Mincer, 1980: 107). Investment diminishes over time because the benefits decline as the payoff period shortens, while the opportunity cost of time is likely to rise over the working life. This is why investments are concentrated at younger ages. Moreover, net investment (gross- depreciation) vanishes or turns negative earlier when depreciation begins to outstrip maintenance, a progression which eventually brings about retirement (Mincer, 1980).

3.5 *Earnings Functions*

An important empirical tool for human capital models is the earnings function, as pioneered by Jacob Mincer. Working with human capital models has involved working with a variety of earnings functions that are derived from the original Mincerian earnings function. According to Mincer (1980), the earnings function is a mathematical and econometric specification of the earnings profile. The basic Mincerian earnings function is usually in the form:

$$\ln Yt = ao + r_s S + a_1 T - a_2 T^2 + u_t \qquad (1)$$

Where Yt is earnings, S is years of schooling, T is experience, and u is the error term. The coefficient of S (r) has been interpreted as the average rate of return to schooling. Mincer (1970,1974,1980) derives this function from the following postulates: Denote Yt as observed earnings; and Et as potential earnings, which is the amount of earnings that could be observed if there was no investment in time t, i.e. the most that an individual aged t could earn if he spent all his time working. The difference between Et and Yt is the part of capacity earnings diverted away from the market for further investment, Ct, which are the forgone earnings. Therefore:

$Yt = Et - Ct$ (2)

But earnings capacity grows over time because of investment so that at time t Et exceeds E_{t-1} by the rate of return on investment incurred in period (t-1).

Thus:

$E_t = E_{t-1} + r_{t-1}C_{t-1}$ (3),

where r_{t-1} is the rate of return on investments in (t-1).

By recursion:

$$E_t = E_0 + \sum_{j=0}^{t-1} r_j C_j \quad (4),$$

and from (2) then:

$$Yt = E0 + \sum_{j=0}^{t-1} r_j C_j - C_t \quad (5)$$

Eo is the original earnings capacity, i.e. before investment or earnings capacity for someone who has never been to school. The next step is to express the variables on the right-hand side of (5) in terms of time spent in investment or earnings foregone. They are expressed in this way because the monetary costs of investments are not observable in data, especially for post-school investment. Mincer accomplishes this by viewing the ratio of investment expenditure to gross earnings (k_t) as a time equivalent amount of investment:

$k_t = Ct/Et$ (6)

k_t of 20% for instance implies that 20% of the year's gross earnings was spent in investment (Mincer, 1980: 108-109).

From (6) then $C_t = E_t k_t$; and substituting this into (3) then:

$E_t = E_{t-1} + r_{t-1}(E_{t-1}k_t) = E_{t-1}(1 + rk_{t-1})$, and by recursion:

$E_t = E_0(1+rk_0)(1+rk_1)...(1+rk_{t-1})$, which when approximated in logarithms is:

$$\ln E_t = \ln E_0 + r\sum_{j=0}^{t-1} k_j \qquad (7)$$

Segregating the k-terms into schooling and post-school investments equation (7) becomes:

$$\ln E_t = \ln E_0 + r_s\sum_{i=0}^{s-1} k_i + r_p\sum_{j=0}^{t-1} k_j \qquad (8)$$

S represents years of schooling, r_s is the rate of return to schooling, and r_p is the rate of return to post-school investment. Equation (8) is simplified further by using the information that $k_t = 1$ during the schooling phase, implying that: $\sum_{i=0}^{s-1} k_i = S$: (8) is therefore:

$$\ln E_t = \ln Eo + r_s S + r_p\sum_{j=0}^{t-1} k_j \qquad (9)$$

Following Borjas (1981) we assume that post-school investment (k_j) declines monotonically with experience. This is predicted to occur because earlier investments have a longer payoff period, and investments undertaken later in the lifecycle are more expensive. Human capital will therefore increase at a decreasing rate and so will earnings. Borjas (1981: 366) suggests the following functional form describing the path of investment over the life cycle:

$k_t = k_0 - \beta t \qquad (10)$

where k_0 is the initial level of investment ratio, and β is the rate of decline of human capital investment. Rewriting equation (9) in continuous form and substituting equation (10), and integrating yields:

$$\ln E_t = \ln E_0 + r_s S + r_p k_0 T - \frac{r_p \beta}{2} T^2 \qquad (11)$$

Since $Yt = E_t(1-k_t)$, then the earnings function can be written as:

$$\ln Yt = \ln E_t + \ln(1-k_t) \qquad (12)$$

Substituting (11) into (12) for $\ln E_t$ we have:

$$\ln Yt = \ln E_0 + r_s S + r_p k_0 T - \frac{r_p \beta}{2} T^2 + \ln(1-k_t) \qquad (13)$$

The difference between $\ln E_t$ and $\ln Yt$ is $\ln(1-k_t)$. $\ln E_t \approx \ln Yt$ when $\ln(1-k_t)$ is small, and it is small when $k_t \approx 0$; i.e., when there is no more time diverted to investment, potential earnings are equal to actual earnings. Before then, potential would always be greater than actual by the amount $\ln(1-k_t)$. For purposes of econometric estimation $(1-k_t)$ is estimated by one or more terms. If we assume $\ln(1-k_t) \approx -k_t$, then equation (13) becomes:

$$\ln Yt = (\ln E_0 - k_0) + r_s S + (r_p k_0 + \beta)T - \frac{r_p \beta}{2} T^2 \qquad (14)$$

Equation (14) can be approximated by (1) with only an addition of an error term u_t as:

$$Yt = a_0 + rsS + a_1 T - a_2 T + u_t ;$$

where, $a_0 = (\ln Eo - ko)$; $a_1 = r_p k_o + \beta$; $a_2 = \frac{r_p \beta}{2}$; r is the average rate of return to schooling ; T is experience, which is estimated by Mincer as (Age-S - 6), where 6 is the

approximate age at which the individual starts school (Mincer, 1980: 111). Equation (14) has been the basis of most empirical research using human capital models.

Murphy and Welch (1990) point out that quadratic specifications of the earnings function such as the one above result in significantly biased estimates of the earnings profile. They show that the quadratic specification understates early career earnings growth by about 30%-50% and overstates midcareer growth by 20%-50%. They show that alternative specifications reduce the bias significantly. The cubic approximation show a noticeable pattern similar to the quadratic, while the quartic residuals show very little pattern (Murphy and Welch, 1990: 202-217).

3.6 *Extensions of Earnings Functions and some Empirical Results*

Since the pioneering work of Mincer (1974), many earnings equations have been estimated for both developed and developing countries. These estimates have been improving, in terms of both data and the sophistication of the techniques used. The usual procedure for estimating lifecycle patterns was to use cross section age- earnings profiles based on easily available data from census and household micro data. Until recently panel data were not available, but even were they were available they have a major defect that they follow the individual for a limited time period. According to Rosen (1980), cross section data have a limitation in that they mix cohorts experiencing vastly different labour market and education experiences. One major deficiency that was recognised about the simple Mincerian earnings function was that it did not take into account the effects of personal ability and investment financing opportunities as major determinants of earnings. Mincer brings this point clearly when he asserts that " *If equality of*

opportunity prevailed, income differentials will still exist because more able people will have an incentive to invest more. Conversely, even if all people were equally able, different opportunities, due either to differences in inherited wealth or other constraints, would result in differences in investments and therefore earnings" (Mincer, 1980: 121). The omission of ability also leads to a biased estimate of the rates of return to education.

A great deal of research has gone into elucidating the role of ability and opportunity in earnings, reporting generally a positive correlation between education, socio-economic background and measures of ability. Taubman, using data on identical twins to control for differences arising from genetical endowment and family environment concludes that not controlling for genetics and family environment may cause a large upward bias, up to two-thirds of the non-controlled coefficient (Taubman, 1976: 459). Other studies find similar results; i.e., controlling for these variables does reduce the schooling coefficient.[2] An exception is Griliches (1977) who found no left out ability bias in the earnings equation. One major problem for studies that find a major bias however is that, they are confronted with measurement problems. For instance, some use IQ as a proxy for ability, father's occupation for family background, etc.: measures which themselves do not fully capture the variables they are meant to measure. Moreover Mincer (1980) argues that most of the studies find a correction for ability that is minor. Rosen makes a similar conclusion when he argues that *"there is now a sufficient number of such studies to reach something of a consensus that the effects of left*

[2] See Mincer (1980: 120-125 and Rosen (1980: 139-144) for a detailed discussion of these results.

out ability measures bias rates of return to schooling, but the bias probably is less than 30% and may be substantially less than that" (Rosen; 1980: 139).

A second major omission from the human capital models is school quality. Cohort data combine individuals who have gone through different schooling qualities. A study by Card and Krueger (1992), using pupil/teacher ratios, average term length, and relative teacher pay as proxies for school quality, do find that school quality does matter. Men who were educated in states with high quality schools do have higher returns to additional years of schooling. Wise (1975) and others also find a strong school quality effect on earnings[3]. Rosen (1980) questions whether it is school quality that is being measured by these proxies since some studies report immense collinearity among school quality, neighbourhood and family background indicators. He argues that school conscious parents, typically with high socio-economic status, instil similar values in their children and tend to purchase higher quality education for them (Rosen, 1980: 134). The initial distribution of assets therefore matters and those advantages can be transferred between generations. Thus education expansion might be associated with increases in income inequality.

A third omitted variable is usually the hours worked. It is observed that the educated workers spend a greater amount of time in gainful employment than the less educated. This gives them greater opportunity for further job investment and thus ability to command higher earnings in the future. Some studies correct for differences in hours by including a variable log hours in their earnings functions [for instance, Kugler and

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[3] See Rosen (1980) for further discussion of this aspect.

Psacharopoulos (1989), Psacharopoulos and Alam (1991)]. But this correction introduces another potential econometric problem in the form of simultaneous equation bias since hours-worked are endogenous to the model. Such a potential problem is however capable of being tested using for instance a Hausman-Wu test for exogeneity. Most studies, including the above-cited ones, however, do not test for such a potential problem. A fourth problem with human capital models is that returns to experience might vary with level of schooling, in that the more schooled would have a higher rate of return to experience. Psacharopoulos and Layard (1979b) quantify this interaction by extending their earnings functions to include terms in which the level of experience is multiplied by the level of schooling and its square term. The drawback with this formulation, according to McNabb and Richardson is that it imposes an arbitrary structure on the nature of the interaction: there is no reason to be confident that the outcomes are multiplicative. It also makes interpretation of coefficients to schooling and experience difficult. They instead estimate the returns to experience for different schooling groups, and returns for schooling for different levels of experience (McNabb and Richardson, 1989: 58). The last problem with human capital models is that the dependent variable, i.e., earnings is itself not fully measured since most studies usually uses paid out wages as a measure of earnings. The missing components are the fringe benefits and other wage supplements. Such omission creates a downward bias on the measured effects of the human capital investments. Duncan (1976) uses fringe benefits and other nonpecuniary benefits as measures of labour market reward. The findings of this study are that education is a significant determinant of fringe benefits; combining pecuniary and nonpecuniary variables into a composite earnings measure increases the coefficient

of education by as much as 25% in some data. The major problem with including fringe benefits however, is that data on fringe benefits are usually not available on most survey data; thus, the common use of pecuniary earnings as an acceptable measure in most studies.

Apart from extending the human capital function in the ways described above, human capital models have been applied across occupations, sex, regions, industries, sectors, ethnic groups, etc., in both developed and developing countries. Generally earnings functions in both developed and developing countries have been found to explain at least one-third of earnings variations. Many studies on rates of return to education have been conducted in large number of countries.[4] Some notable general results from such studies can be made. Firstly, rates of return are not far off the yield of more conventional investments, i.e., they are comparable to those from physical capital and they do fall over time following education expansion. A pattern of declining returns to investment would be consistent with the equalising effect of educational expansion on income distribution, i.e., other things being equal, an increase in the number of more educated relative to the less educated would narrow the reward structure and hence lead to a lower index of income inequality (Psacharopoulos, 1989: 225-226). Secondly, rates of return are much higher in the developing countries than the developed countries - reflecting both scarcity of human capital and barriers to the allocation of funds to human capital in developing countries. Moreover, the power of formal education as an explanatory factor in earnings is significantly greater in developing counties[5]. Third,

[4] See for instance Psacharopoulos (1985,1994) for a summary of these studies.
[5] See Psacharopoulos (1985, 1994)

returns decline by level of schooling, i.e., they are highest for primary, followed by secondary and least in higher education. These rates of return are calculated using both the elaborate method and earnings function method specified with dummies for different levels of education.

Fourth, private rates are typically higher than social rates because of public subsidisation of education in all parts of the world. Fifth, the maximum distortion between social and private rates is at the university because this level is more heavily subsidised in most countries relative to other levels. Sixth, both private and social returns are higher in the private sector than in the public sector of employment- due to compressed public sector pay structure. Seventh, more general curricula have higher rates of return than vocational education - due to higher unit costs for vocational education from more specialised faculty and equipment.

Lastly, females often yield a higher rate of return to education investment than males, even though their average earnings are less than those of males. This is because generally females face lower forgone earnings (Meier, 1995: 322-324, Psacharopoulos, 1989, 1994, Mazumder, 1989, Jain, 1991). Experience and education are the most significant variables in explaining variance of logarithm of earnings which is a measure of inequality (Psacharopoulos, 1989).

Evidence also seems to be more consistent with the human capital theory of the relationship between earnings and education, rather than alternative theories of screening, segmentation, etc. (Psacharopoulos, 1989). These general results are however not without exception for certain general aspects discussed above. Ecuador for instance, had a u-shaped kind of behaviour of rates of return; returns were highest for primary, but

rate of return for secondary education was lower than of university education (Gomez-Castellanos and Psacharopoulos, 1990). These rates were calculated using the elaborate method. This is a three step procedure. In the first stage a regression of the type:

$$Y_i = a + b\,AgeE_i + c\,AgeE_i^2 \qquad (15)$$

is fitted within subgroups of workers with the same level of education. In the second step, age-earnings profiles are constructed by predicting the values of Y for given ages and educational levels using formula (15). In the last step, the predicted values of Y are inserted into formula (16) in order to compute the rate of return (r) for each subgroup by level of education:

$$\Sigma(Y_p - Y_{ne})_t\,(1+r)^{-t} = 0 \qquad (16).$$

where p stands for primary and ne stands for no education, and so on for secondary and higher education. Levels of education variables are entered as dummy variables (Gomez-Castellanos and Psacharopoulos, 1990: 221-222).

For Brazil and Venezuela, the rate of return was higher for specialised education rather than for general education (Tannen, 1991; Fisbein and Psacharopoulos, 1993). Bennel (1996) concludes that rates of return studies in Sub Saharan Africa have deficient and/ or incompatible data and methodologies. Secondly, that the conventional rates of return patterns almost certainly do not prevail in Sub Saharan Africa under current labour conditions.

3.7 *Methodology*

The model to be used is the Human Capital Model developed by Mincer (1974) with some modifications. In this respect, education is seen as purely an investment in oneself during school and later through training on the job. The standard Mincerian empirical model is in the form:

$$\ln Y_t = a + bS + cT + dT^2 + u \qquad (17)$$

where:

$\log Y_t$ = the log of earnings in year t.

S = Years of schooling

T = experience (post-school investment in human capital)

T^2 = experience squared

u = the normally distributed residual variance in earnings.

a = entry-level wage to a new labour market entrant with no schooling;[a> 0]

b = average rate of return to schooling; [b>0]

c, d = coefficients describing the of growth of earnings over the life cycle;[c >0]; [d <0]; the negative value for d is to capture the concavity of the observed age- earnings profile. This is a result of diminishing marginal returns to on-the -job training and rising marginal costs of further training over time.

Two additional independent variables are added to this basic model; the logarithm of hours worked to compensate for the differences in hours worked; and family background to capture the parental background effect in determining investment. Family background is approximated by including dummy variables on education of the head of the household and education of parents. This is important for Botswana's economy given

the relatively unequal distribution of income and wealth. Chernichovsky points out that *"the variable with the most significant impact on child schooling is the education of the person heading the household: the more educated the head of the household, the more likely are his or her children to be enrolled in school, the longer their stay in school before dropping out, and the higher the level of schooling of children still enrolled"* (Chernichovsky, 1985: 329). Patrinos (1995), measuring family background by father's education, finds that in Greece the rates of return to education rise as the educational attainment of the worker's father increases. Jallade (1982) breaks down Brazilian population into 14 socio-economic groups using sex, place of residence, place of origin, and socio-economic background. He concludes that rates of return to primary education tend to be highest for the highest income group and lowest for the lowest income group. The rates of return to secondary education show a less clear pattern (Jallade, 1982: 188-189).

Using ordinary least square methods, equation (17) will then be run separately for male and female workers; employed and self-employed; public and private employment - especially to test whether screening might be prevalent in Botswana's labour market. High rates of return to workers in the public sector (which is assumed to be less competitive) compared to the private sector, will indicate some screening role of education (Psacharopoulos, 1979a, Ziderman, 1990,1992, Lambropoulos, 1992). Data are also available by location, which allows for calculation of rates of return for each location. Age-earnings profiles will also be constructed for each level of education; which is smoothed out by applying a regression of the type:

$$Yi = a + bAge_i + cAge_i^2 \qquad (18).$$

This regression is fitted within subgroups of workers with the same level of education. Equation (18) is an ad hoc fitting regression.[6] Comparing the earnings functions for the formal sector and the non-formal sector also tests screening, (which for the Botswana economy are mostly self-employed)[7]. The self-employed are the unscreened group, while the employed are the screened group.

Earnings are to be defined as gross wage or salary plus any other allowances like car allowance, etc. To adjust for net wages we subtract taxes from gross earnings. This distinction will be important for distinguishing between social and private returns. To calculate private returns to the individual investor, the regressed lnY will be the net earnings. The variable for experience usually used in most human capital empirical work is an estimate for potential experience; which as derived from Mincer (1974) is approximated by A-S-6; where A is the age; S is the level of schooling, and 6 is an approximate age at the beginning of schooling. This estimate assumes that the individual spends all time after graduating in work until retirement. But factors such as extended periods of unemployment may bias this estimate. It is especially true for women, who might have spent most of that time raising children at home. The supplementary survey generated the actual years of experience as a measure of T to avoid this potential bias. With the HIES data, we approximate experience in the usual Mincerian way.

Two rates of return are estimated in this study; the social rate of return and private rate of return. Private rates of return are useful for explaining people's behaviour in seeking education of different levels and types. Social rates of return, on the other hand,

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[6] See Psacharopoulos (1990,1991) for a discussion on smoothing out age-earnings functions.

[7] See Rempel, et al (1994) for results on informal activity in Botswana.

can be used to set priorities for future educational investments (Psacharopoulos, 1994). In order to estimate the private rate of return to different levels of education, we convert the continuous years of schooling variables into a series of dummy variables referring to completion of main schooling cycles; primary, secondary, and higher level of education. Equation (17) is therefore modified into:

$$\ln Y_i = a + \sum_k b_k D_{ik} + cx_i + dx_i^2 + e\ln H + fF + u_i, \qquad (19)$$

Where D_{ik} are dummy variables and k stands for level of education; H is hours of work and F is family background variables. In this specification, the rate of return to the kth level of education (r_k) is estimated by comparing the coefficient of D_k with that of D_{k-1} and divide by the number of years of schooling at the kth level; i.e. $r_k = \frac{b_k - b_{k-1}}{n_k}$. In this study equation (19) is specified as follows:

$$\ln Y = a + b.PRIM + c.SEC + d.HIGH + e.T + f.T^2 + g.H + h.F \qquad (20),$$

where Prim, Sec, and High are the categories of education, with T being experience; h> 0, implying that those with more educated parents have more schooling and thus earn more. The rates of return to the different levels of schooling are derived from the estimated coefficients b, c, and d from (20) as follows:

$$r_{(\text{primary versus illiterates})} = \frac{b}{S_p}$$

$$r_{(\text{Secondary versus Primary})} = \frac{c-b}{S_s - S_p}$$

$$r_{(\text{higher versus Secondary})} = \frac{d-c}{S_h - S_s}$$

where S stands for the number of years of schooling of the subscripted education level (p= primary, s= secondary, h= higher). The coefficients are first adjusted by $(e^{\text{coefficient}}) - 1$[8].

[8] This is in line with Halvorsen and Palmquist (1980). They point out that the value of the coefficient of a dummy variable in semilogarith regression equation is not a good estimate of the effect of that variable on the variable being explained for large values of the coefficient. We therefore adjust as per their suggestion.

A recent line of research has questioned the empirical validity of the assumption of equal returns for each year of schooling, and that returns to a partial completed school cycle are zero (Hungerford and Solon, 1987; Dabos and Psacharopoulos, 1991; Dougherty and Jimenez, 1991; Griffin and Edwards, 1993). To allow for more flexibility in determination of education-earnings profiles and rates of return, separate dummy variables for each year of schooling completed are entered into earnings regressions and compared with those obtained by using level of education dummies. Using each year of education competed dummies allows us to compute rates of return for each year of education completed, instead for each schooling cycle. Adopting this more flexible way, Dougherty and Jimenez (1991), Griffin and Edwards (1993) find results that indicate that earnings education profiles are convex and that rates of return rise with level of education. This might be due to a possibility that more able people obtain more schooling, or that the quality of education increases as one moves up the education ladder, or that direct costs, which are higher as students move up the educational ladder, are not taken into account (Griffin and Edwards, 1993: 249-250).

The rate of return so computed with the regression method, however, only takes into consideration the forgone earnings as the only type of cost. To account for the private direct costs of schooling a second method is used; we use the elaborate method, which amounts to using the standard formula for internal rates of return:

$$\sum_{t=1}^{n}\frac{B_t}{(1+r)^t}=\sum_{t=1}^{n}\frac{C_t}{(1+r)^t} \text{ or } \quad \sum_{t=1}^{n}\frac{B_t-C_t}{(1+r)^t}=0 \qquad (21)$$

where :

B= benefits, C = costs, r = internal rate of return, n = the period of stream of costs and benefits. This formula is used to calculate the overall rate of return rate of return to education investment, and rates of return for each level of education. To calculate the overall rate for instance we use $B_t = (B_p + B_s + B_h)_t$ and $(C_p + C_s + C_h)_t$, where the Bs

are marginal economic benefits in the form of additional net earnings (after tax income) for primary, secondary and higher level respectively. The Cs are also the marginal costs for those levels.

To calculate the rate of return for an individual level of school, the same formula above is used, but now the benefits are the differences between the earnings of that level and the preceding one. The opportunity costs are measured by the wage of the proceeding level multiplied by the number of years taken for that level. Unlike the costs based on the Mincerian earnings function, the costs used in the formula above include both opportunity costs and direct individual costs. One other advantage of using this method as opposed to the Mincerian earnings function is that forgone earnings for primary school children can be explicitly adjusted. Psacharopoulos (1994) observed that primary school children, mostly those aged 6-12, do not forego earnings during the entire length of their studies; hence it is a mistake to mechanically assign them six years of forgone earnings as their opportunity cost of education. With this method we can, however assign some reasonable years of opportunity cost for primary education (usually three years). Assigning opportunity costs to more years of primary education might not bias the rates of return to education grossly for the Botswana economy, given that girls and boys do help a lot in the rural household even before they are ten years of age. The job of taking care of the small stock falls in large part to younger boys, while older boys (10 and over) herd and water the cattle. Mueller (1984), Chernichovsky (1985), document substantial economic contributions of children to the household even at early ages, normally starting to be deterrent to schooling at age 9 and above. This study therefore assumes three years as reasonable years to assign to opportunity cost to primary schooling.

To compute social rates of return, we use the same formula above, but now the benefits are calculated using gross earnings (earnings before tax). The costs will also

have added to opportunity costs and individual costs to education the cost per student from society as a form of grant or subsidy.

To deal with the equity issues of education three things are considered. First, a ratio between social and private rates of education for each level is calculated. A high ratio implies that the level of education is more highly subsidised than others. A second method used is to calculate rates of return to different socio-economic groups categorised on the basis of family background which are proxied by education of the head of the household and education of parents. Returns are expected to rise as the education of the head of the household and parents increase, suggesting a positive interaction between schooling and social origin in the earnings determination process. Patrinos (1995) points out these results may be due to two things; first that students with more educated parents score higher marks because of a more conducive learning environment rather than their inherent ability; and second that those from privileged backgrounds obtain better jobs regardless of their skill because they have more contacts. Heckman and Hotz (1986) also find that the education of the mother had persistently strong and robust effects on earnings for males in Panama.

A difficulty in estimating earnings functions by groups is that the actual samples of individuals selected, particularly those with positive earnings, may not be completely random, as mechanisms of self-selection may be at work to determine ones employment or educational status. Using a two-stage estimation procedure proposed by Heckman (1976) the inverse of Mills' ratio in earnings models are constructed for various regimes. This is then inserted into the right hand side of the earnings equation before re-estimating it.

3.8 *Data and Testable Hypotheses*

Following standard Mincerian procedure, the study uses cross section data from the 1993/94 Household Income and Expenditure Survey (HIES). This is a survey that is made every ten years, this being the second one. The data generated from this survey is micro data collected at the household level. It reports for instance, occupation by industry, gross wage and deductions from wage, education of all family members, age, gender, and expenditure on education. This data is supplemented by a sample survey done by the author in 1996. This was necessary to test some of the issues in which HIES data was thought to be inadequate.

A number of hypotheses are tested using the methodology and data described above. These are as follows:

1) the returns to education are higher in the private sector than the public sector supporting the productivity-enhancing role of education in the private sector and some screening role and compressed pay structure in the public sector;

2) given the high subsidisation of education in Botswana, the private rate of return to education is higher than the social rate of return, with the highest distortion being at the higher levels of education;

3) those from less privileged backgrounds experience lower returns to schooling at all levels of education;

4) returns to education (both social and private) decline by level of schooling reflecting diminishing returns to schooling, i.e., returns to primary schooling are higher then secondary education, and the latter is higher than returns to higher education; and

5) returns to education for females is higher than for males given their lower forgone earnings.

3.9 *Limitations of the study*

There are a number of limitations to this study. The first limitation relates to the use of cross sectional data. To construct life-cycle age earnings data one needs panel data that follows individuals for a substantial amount of time. Cross section data mixes individuals who have gone through different schooling cycles and employment experiences, i.e., it combines cohorts that might have gone through significantly different experiences both in school and in the labour market. Panel data is however still a luxury in the developed countries, let alone the developing counties where it's not available; thus almost all studies on rates of return and earnings differentials use cross section data. The second limitation is that there is no control in the model for the quality of education and ability. The major problem with quality of education variable however, is that, there is usually no precise way of measuring it except by using proxies like teacher's education, pupil/teacher ratios, etc. Such data, however, is usually not available in micro data and is not reported in HIES. Given Rosen's (1980) observation regarding strong collinearities between school quality and family backgrounds indicators, part of the omission for school quality might be taken care of by the family background variable included in this study. Not correcting for ability does bias the results upwards. Data limitations do not allow for no-monetary benefits to education. Benefits to education are therefore limited only to monetary benefits. Due to data limitations, we also do not deal with the wastage in all the education cycles. Some people might require more years to complete an education cycle than others. This will have the effect of raising the cost side and therefore lower the rates of return to education. We also do not include capital costs in our consideration of costs. This omission creates a bias in favour of tertiary education since the capital costs for upper levels are much higher than for lower levels. One of the

major problems of dealing with capital costs is how to find the depreciation value for the things like buildings, equipment, etc.

CHAPTER FOUR

THE BOTSWANA LABOUR MARKET

4.1 Introduction

The main purpose of this chapter is to investigate the relationship between education and earnings in Botswana. The first section gives an overview of the relationship in general. This is followed by a discussion of the development of the major institutional structures that influenced the labour market in Botswana. In the next sections we present some major characteristics of workers from the 1993/94 Household Income and Expenditure Survey (HIES) data and a supplementary survey data. This is followed by a discussion of the major sources of earnings differentials using HIES data and a supplementary survey data. This involves fitting Mincerian earnings functions by gender, location, and type of employment and type of organisation.

The last two sections present age/experience- earnings profiles from both data sets and a discussion of the relationship between education and the labour markets over time.

4.2 *Education and labour markets*

Human capital theory relies on observed earnings differentials as a means to measure the benefits to a certain level of education. Understanding how the labour market functions to determine those earnings is therefore important to understanding the human capital model. A major assumption of the human capital model is that the labour market is perfectly competitive. The implication of such an assumption is that the wages that are paid to the workers reflect their marginal productivity and are determined by the

forces of demand and supply. The demand and supply functions in turn reflect the profit maximisation behaviour of employers and the utility maximisation of workers and a notion of competitive equilibrium. The interaction of demand and supply would determine the equilibrium wage and employment and would adjust the market back to equilibrium whenever a disequilibrium situation exists. If there is an increase in high school graduates for instance, the market will automatically adjust their wages downward to reflect the abundance of such skill relative to demand.

Since the 1970's a wide range of alternative labour market theories have been developed. The theories have emerged largely in response to a number of empirical observations of the industrialised countries labour markets which have been at odds with the implications of the neo-classical theory. Hinchliffe (1987) mentions poverty and income inequality, failure of education and training to raise the incomes of the poorest groups, among others, as the empirical oddities observed. The alternative theories of labour market functioning can be divided into labour market segmentation and job competition models. Generally, segmentation models assert that labour markets are characterised by a number of segments, each of which has different conditions of employment, and recruits among different segments of the labour force (Hinchliffe, 1987). In developing countries for instance, segmentation may be in the form of formal versus informal sector labour market; where a worker employed in the latter can not easily move to the former. The implication is that the workers in the formal sector are sort of sheltered from competing with those outside the sector. Such labour market sheltering usually comes in the form of institutional factors such as unions.

The job competition model is based on the uncertainty that surrounds the hiring of labour; i.e., the firm usually does not have much information about the worker during hiring time. As a result, highly structured labour markets develop within the firm. A worker is recruited to a career path and not a job and his or her earnings might initially be lower than the alternative earnings, during the probation or training period. Wages are based on characteristics of jobs rather than the characteristics of the people in them. An important aspect of alternative models to the neo-classical model is that firms react to changes in supply of workers and other demand shocks by adjusting quantities rather than prices, numbers employed rather than wages. As a result, we have sort of "bumps", where the educated worker "bumps" the less educated workers out of the jobs. Bumping rests on the assumptions that both rigid wages and education screening are important features of the labour market, assumptions that are likely to be true in countries where the public sector is a large employer. Mazumder summarises the bumping model by pointing out that, "*What happens when the supply of educated labour continues to outrun the demand for labour in those jobs for which the educated are typically employed? Over time, employers respond to the excess supply by raising the minimum educational requirement for those jobs...as long as there are job seekers with fewer years of education who are being crowded out, the rate of return to education will not fall.*" (Mazumder 1989: 89).[9]

[9] For further discussion on education and alternative labour market models see Bhagwati and Srinivasa (1977); Thurow (1976).

4.3 *Overview of Botswana's Incomes Policy*

Botswana inherited from the colonial period a public sector salary structure based the racial discrimination of the South African system. At independence there was a 36 to 1 ratio between the highest and the lowest paid jobs (Harvey and Lewis, 1990). The government planned to reduce that ratio from the early stage by increasing the wages of the lowest paid, while holding constant the pay of the highest paid. The first major step was a consultancy in 1970 which undertook a study of wages and wages policy in Botswana. The report constituted the basis for a White Paper, "National Policy on Incomes, Employment, Prices and Profits; Government Paper No. 2 of 1972" (Kann, et al. 1988: 101).

The policy stated that private sector salaries were to conform to, and, on no account significantly exceed those in government. Minimum wages in the formal sector were also instituted and were to be based on comparable rural incomes (Republic of Botswana, 1972). The implementation of the incomes policy was monitored by a body bringing together government and representatives of employers and employees known as National Employment, Manpower and Incomes Council (NEMIC). The implementation of the policy has, however always been voluntary since there was no legislation to back it up. Minimum wages are applied to unskilled employees and have legal force in the construction, manufacturing, road transport, trade and hotel sectors (Kann, et al. 1988: 102). To facilitate more control of wages in the parastatal and private sectors, another structure, the Wages Policy Committee (WPC) was created. Its main function was to process and approve private and parastatal sector wages and salaries. This was sort of a "watch dog" for government over these sectors. The members of WPC were senior government officials. The private sector employers and trade unions were not represented in this committee (Colclough and Olsen, 1983)

Despite the fact that the Incomes Policy was based on voluntary restraint by the parastatals and the private sectors of the economy, some parts of the policy functioned

successfully. One notable aspect is that the earnings in the private and parastatal sectors kept their relationship to the public sector up to at least the mid 1980s (Kann, et al. 1988). Salaries differentials between top level worker and lower level worker also decreased. The pay of a permanent secretary to that of an unskilled labourer fell from 26:1 in 1970, to 13:1 in 1974, where it stayed until there was a reversal to 17:1 in 1978. The pressure for reversal was mainly coming from more citizens moving into higher civil service grades (Colclough and McCarthy, 1980). Another source of pressure for higher incomes at the senior level was the widening gap between local and expatriate employees doing comparable jobs. Since government was recruiting expatriates internationally, expatriate incomes rose, while citizen salaries were being held down.

Despite the pressure from citizens, government managed to keep the ratio fairly constant at around 17 or 18 to one up to the mid 1980's (Harvey and Lewis, 1990). Oommen shows that distribution of wages/salaries within the formal sector as a whole was more equitable between 1974 and 1979. The gini-coefficient for 1974 was 0.58 for all employees and falls to 0.49 when only citizen earnings are considered. For 1979 the gini-coefficient works out to 0.57 and 0.45 for all employees and citizens respectively. It is evident that it was the non-citizen earnings that made the distribution less equitable (Oommen, et. al, 1983: 44-45).

Towards the end of the 1980's, however, government had to yield to the pressure as it was losing much of its skilled manpower to the unrestricted private sector. The result was a 1990 "decompression" exercise that was aimed at decompressing salaries of the public sector to give an incentive for workers to stay with government. This was a part of the 1990 Revised National Incomes policy. Among other things, the top person in the civil service received an increase of 83%, while the bottom person received just an inflationary adjustment of 12%. The results of this exercise were that the income differential increased tremendously to about 34 to 1, almost doubling (Republic of Botswana, 1990).

The Revised 1990 Incomes Policy provides that private sector wages are to be market determined, with the need to remain competitive and the profit motive constraining the degree to which salaries could be raised. To make sure wages are set with caution, government salary adjustments are supposed to provide a reference point around which wage settlements between employers and employees should be negotiated. On the other hand, parastatals were restricted to conform to the top and bottom wages and salaries of government. Between the top most paid worker and the least paid one, parastatals were no longer required to tie wages and salaries job-to-job with government scales (Republic of Botswana, 1990).

A major source of influence on wages and salaries in Botswana was a series of Salary Review Commissions in the public sector. Since wages in the private and parastatal sectors were tied to the public sector wages, this meant indirectly influencing wages in those sectors. Since 1981, annual reviews of public sector salaries have been carried out as part of government annual budget activity. Most of it has usually been annual across the board inflationary adjustments to wages and salaries.

4.4 *General Summary of Data*

In this section we present an analysis of Botswana' labour market from two data sets; the 1993/94 Household Income and Expenditure Survey (HIES) and a supplementary Survey to HIES done in 1996.

The Household Income and Expenditure data was provided by 3608 households living in randomly selected dwellings all over Botswana. These households were selected from dwellings within 144 blocks randomly selected from 3088 blocks. This represents approximately 4.5% of the blocks. Seventy-two of these 144 blocks are from the urban areas, while 36 are from the urban villages and the remaining 36 are from the rural areas

or villages. For the purpose of this study only those with positive earnings aged between 15 and 65 years of age were selected. The number of cases (after removing some obvious outliers) was 3382 cases with 3141 (93%) being citizens and 241 (7%) being non-citizens. Males comprise of 1870 (55%), while females were 1512 (45%). Forty-six percent were never married, 33% were married, and 17% were living together. Ninety-two percent or 3101 were employed, while 8% (281) were self-employed. For the non-citizens, 73% of the employees were male, and only 27% were female.

For female employees 56% were never married, 23% were married, and 16% were living together. For male employees 46% were never married, 33% were married and 19% were living together. Therefore, a higher percentage of women (56%) were never married compared to 46% of men. The location of the sample is as follows:- 2086 (61.7%) urban, 839 (24.8%) urban villages, and 457 (13.5%) rural dwellers.

The supplementary data was provided by a subset of the households selected for the CSO Household and Income Expenditure Survey (HIES). These were selected randomly using proportionality to size of the block from 108 blocks selected from urban areas and urban villages for the HIES study. A total of 25% of the sample was taken, making a total of 27 blocks, 18 from urban areas and 9 from urban villages. The target group interviewed were those Batswana who had positive earnings from labour and self-employment over the past thirty days and were aged between 15 and 65 years.

The number of usable cases is 1026, of which 813 (79%) are taken from selected urban areas, while 213 (21%) are from the nine urban villages selected. Males comprise of 532 (52%), while females are 494 (48%). A majority of the workers (55%) were never married, while 25% are married and 16% are living together. When data is disaggregated

by gender of respondent, marital status has a similar trend to the aggregate for both sexes, with a higher percentage being those who have never been married, followed by those who are married, then those living together. Sixty percent of women were never married compared to 51% of men. Ninety-one percent of the respondents are employed, while 9% are self-employed. Sixty-three percent of the heads of the households are male, and female heads make up 37% of the sample.

4.4.1 Characteristics *of workers by citizenship*

Tables 4.1 shows characteristics of workers by citizenship, while table 4.2 shows the t-values which are used to test for significance of differences in means of various characteristics between citizens and non-citizens. The mean earnings of all the workers is P923.96. Non-citizens earn about four times more on average than their citizen counterparts. Republic of Botswana (1992) shows earnings differentials between non-citizens and citizens of 5:1. Our results show a lower earnings gap than that reported in 1992. This is mainly due to higher increases in average earnings of citizens than was obtained by non-citizens over time (Republic of Botswana, 1992: 2).

Non-citizens in the HIES sample are also five years older on average than the citizen workers. The differences in earnings and age between citizens and non-citizens are significantly different from zero at the 1% level. Non-citizens also have a significantly higher percentage of them with some training than citizens. That difference is also significant at 1% level. The only advantage for citizens is that they have a slightly higher potential experience than non-citizen employees. The difference in means of potential experience is nonetheless not significant even at 5% level. The high average earnings of non-citizens are therefore explicable by their higher average education and a larger

proportion of them having gone through some training than their citizen counterparts. These results are expected, given that in most cases, non-citizens fill up manpower gaps in post for which citizens do not have the necessary education and training.

Table 4.1 *Characteristics of workers, means and standard deviation of selected variables in the sample, overall and by Citizenship (HIES)*

Variable	Mean	Standard Deviation	Sample Size
1. Monthly earnings			
All	923.96	1224.99	3101
Citizens	756.25	891.53	2891
Non- Citizens	3232.71	2349.97	210
2.Age			
All	34.24	10.52	3101
Citizens	33.91	10.49	2891
Non-citizens	38.88	9.91	210
3.Potential experience			
All	18.37	11.03	3101
Citizens	18.39	11.13	2891
Non- citizens	18.07	9.62	210
4.Years of schooling			
All	7.3	4.46	3101
Citizens	6.8	4.17	2891
Non- Citizens	13.72	3.17	210
5.Training(1,0 otherwise)			
All	0.28	0.45	3101
Citizens	0.24	0.43	2891
Non- citizens	0.73	0.45	210

Table 4.2 *t- values for some variables between citizens and non-citizens (HIES)*

Variable	t-values
Gross Income	15.19**
Age	6.99**
Potential Experience	0.45
Years of Schooling	29.67**
Training	15.24**

** Significantly different from zero at 1 % level of significance

4.4.2 *Characteristics of Workers by gender*

Table 4.3 shows the mean values and standard deviation of characteristics of the HIES sample of workers by gender, while table 4.4 presents t-values for differences in characteristics between gender. Fifty-six percent of the sample is male. In 1991 women made up 34% of the formal labour force (Republic of Botswana, 1992: 2). A strict comparison of these figures would imply that female participation in the labour market has been increasing between these periods. Male employees from the HIES sample are on average significantly much older than female employees. Male employees are also on average more experienced than females. The differences in mean age and potential experience between sexes are significantly different from zero at the 1% level. This is explained by the fact that not many female Batswana participated in the formal labour market in the past.

Female employees are on average more educated than males but they earn much less than males on average. Male employees on average earn 1.6 times more than female

workers. As table 4.4 shows, the differences in earnings and education are significantly different from zero at 1% level. Kann, et al. (1988: 108) show similar results. They show that for every level of education obtained women have lower average monthly salaries than men. No attempt is made to explain the discrepancy in salaries by gender.

Table 4.3 *Characteristics of workers, means and standard deviation of selected variables in the sample, overall and by gender (HIES)*

Variable	Mean	Standard Deviation	Sample Size
Sex (1 =M, 0 =F)	0.56	0.5	3101
Age			
Overall	34.25	10.52	3101
Male	35.26	11.25	1744
Female	32.95	9.34	1357
Potential Experience(yrs)			
Overall	18.37	11.03	3101
Male	19.36	11.69	1744
Female	17.09	9.98	1357
Years of Schooling			
Overall	7.3	4.46	3101
Male	6.92	4.88	1744
Female	7.79	3.81	1357
Monthly Earnings(Pula)			
Overall	927.41	1242.37	3101
Male	1111.23	1436.92	1744
Female	691.52	881.19	1357

Table 4.4 *t- values for some variables between male and female workers (HIES)*

Variable	t-values
Gross Income	9.97**
Age	6.26**
Potential Experience	5.83**
Years of Schooling	5.53**
Training	0.31

** Significantly different from zero at 1 % level of significance

* Significantly different from zero at 5% level of significance

Table 4.5 shows some major characteristics of the workers from the supplementary survey (SS) sample and table 4.6 shows the t-statistics. The mean earnings of all the workers is P857.18. Male workers on average earn more than their female counterparts. The ratio is about 1: 1.5 in favour of male workers. On average, male workers are a year older than female workers, and have an average of three years of experience more than female workers. Female workers have higher average years of schooling. Except for differences in years of schooling, all the other differences between means of characteristics between sexes are significantly different from zero at 1% level of significance. Mean differences in years of schooling between sexes are however significantly different from zero at 5% level of significance. Both sexes have an equal percentage of workers with some training (38%). With the exception of years of schooling (which is significant at only 5% level), all the differences in means between male and female workers are significantly different from zero at 1% level of significance.

From both samples, generally male workers are much older, have higher number of years of experience and earn significantly more than their female counterparts. Females, however, are more educated than males. The lower earnings of women and yet their higher average years of education is indicative that there might be some discrimination against women in the labour market.

Table 4.5 *Characteristics of workers, means and standard deviation of selected variables in the sample, overall and by gender (SS data)*

Variable	mean	std. deviation	sample size
1. **Monthly earnings**			
All	857.18	897.56	1026
Males	1030.16	1045.33	532
Females	670.89	656.48	494
2. **Age**			
All	32.72	8.8	1026
Males	33.6	9.1	532
Females	31.7	8.5	494
3. **Experience.**			
All	9.4	7.4	1026
Males	10.8	8.01	532
Females	7.7	6.2	494
4. **Years of schooling.**			
All	8.1	3.7	1026
Males	7.9	4.0	532
Females	8.4	3.2	494
5.Training (1,0 otherwise)			
All	.38	.48	1026
Male	.38	.48	532
Female	.38	.48	494
6. Hours of work			
All	192	54.13	1026
Male	188	43.00	532
Female	197	63.72	494

Table 4.6 *t- values for all the variables between sexes (SS data)*

Variable	t-values
Gross Income	6.64**
Age	3.33**
Experience	7.05**
Years of Schooling	2.10*
Training	0.04
Hours worked	2.61**

** Significantly different from zero at 1 % level of significance

* Significantly different from zero at 5% level of significance

4.4.3 *Distribution of sample by education level*

Table 4.7 shows the proportion and percentages of workers in the HIES sample with different levels of education by gender. When the sample is disaggregated by level of education attained, it is clear that male employees have a higher percentage of workers with less education than their female counterparts. In the zero years and 1 to 4 years of education categories males have a higher percentage (35%) and females a lesser percentage (18%). For 5 to 10 years of education, females have a higher proportion of 68% as against male's proportion of 59%. For education higher than 10 years, the percentages are the same between gender. It is therefore clear that the higher average education for female workers than their male counterparts is due to a large number of them having attained higher primary education and lower secondary levels of education than their male counterparts.

If we define a good education as those with at least a higher primary education level, females have a higher proportion (82%) of workers in the sample with a good education than male workers (66%). To test for statistical significance of the differences between these two proportions we calculate the Z-value[10]. The calculated Z-value = -9.6. Since the absolute value is greater than the tabled value (1.96), we reject the null hypotheses that the difference in proportions of workers with good education between male and female workers in the sample is not significantly different from zero. The difference in proportions is even significant at 1% level. We can therefore conclude that female workers in the sample have a significantly higher proportion of them with a good education than male workers in the sample.

If we define a good education as those with at least a lower secondary (in line with the present government policy of providing every Motswana child with at least this level of education), the proportion of male workers in the sample with that education is 35% while that of females is 47%. When we test for the significance of the differences between the proportions we obtain a z-value = -6.55.

Since this value is greater than the tabled value, we still reject the null hypothesis. The differences in proportions are also significant even at 1% level of significance.

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[10] The general formula is $Z = \dfrac{\frac{x_1}{n_1} - \frac{x_2}{n_2}}{\sqrt{p(1-p)(\frac{1}{n_1} + \frac{1}{n_2})}}$, where $p = \dfrac{x_1 + x_2}{n_1 + n_2}$

Table 4.7 *Distribution of respondents by level of education, overall and by gender - citizens only (HIES)*

Education	Overall	Male	Female
No Schooling	487 (17)	359 (23)	128 (10)
1- 4 years of schooling	283 (10)	178 (11)	105 (8)
5- 7 years of schooling	948 (33)	493 (31)	456 (35)
8-10 years of schooling	761 (26)	330 (21)	433 (33)
11-12 years of schooling	296 (10)	159 (10)	136 (10)
13 + years of schooling	113 (4)	67 (4)	46 (4)

Table 4.8 shows the proportion and percentages of workers in the supplementary survey sample with different levels of education by gender. Male workers have higher percentages for all levels of education with the exception of lower secondary. A larger percentage of female workers (58%) have at least lower secondary compared to male workers (48%). It is clear therefore that the high average schooling attainment by female workers is due to a larger proportion of them going through lower secondary compared to their male counterparts (40 % compared to 28% of males).

If we define a good education as those with at least a higher primary level of education, females have a higher proportion (89%) of people with a good education than male workers in the sample (83%). Testing for statistical significance of the difference between these two proportions gives us a Z- value = -3.03.

Since the absolute figure of the calculated Z-value is greater than the tabled value (1.96), we reject the null hypothesis that the proportion of male people with good education is equal to that of female workers in the sample. In other words, a significantly greater proportion of female workers has a good education compared to male workers. The difference in proportion of people with good education is even significant at 1% level of significance.

If we define a good education as those with at least a lower secondary (in line with the present government policy of providing every Motswana child with at least this level of education), the proportion of males with that education becomes 48% while that of females is 58%. When we test for the significance of the differences between the proportions we obtain a z-value = -3.2.

Since this value is greater than the tabled value, we still reject the null hypothesis. The differences in proportions are significant even at 1% level of significance.

Defining good education as either having at least high primary or at least lower secondary, indicates that a significantly higher proportion of female workers in both the HIES sample and SS sample have a good education than male workers. Kossoudjie and Mueller (1983) show similar results. Using the 1975/75 Rural Income Distribution Survey data (RIDS), they show that Botswana is one of the few places in the world where women obtain more schooling than men. They find the main reason to be the role that boys play in cattle herding, which usually takes them away from the village and increases the opportunity cost of their time (Kossoudjie and Mueller, 1983: 849). This could still be the major reason for the differential in schooling that we observe in our sample, especially for the older generation. The validity of this reason is however, very

questionable when applied to the recent cohorts given that boys do not spend that much time in the cattle post.

We have shown from our data that female workers earn significantly less than their male counterparts despite their higher average education. The lower earnings of women and yet their higher average education might indicate that women are discriminated against in the labour market. The last part of this chapter will attempt to provide some answer to this issue.

Table 4.8 *Distribution of respondents by level of education, overall and by gender (SS data)* *

Education	Overall	Male	Female
No Schooling	68(6.6)	48(9)	20(4)
low primary	77(7.5)	44(8.3)	33(6.7)
high primary	339(33)	183(34.5)	156(31.6)
lower secondary	346(33.7)	149(28)	197(39.9)
higher secondary	125(12.2)	67(12.6)	58(11.7)
post secondary	71(6.9)	41(7.7)	30(6.1)
TOTAL	1026(100)	532(100)	494(100)

* Percentages are shown in brackets

4.4.4 *Average Earnings of workers in sample by education level*

Table 4.9 shows average monthly earnings of workers in the HIES sample by education levels. For both sexes average earnings increase as the level of education increases. For all citizen employees those with post-secondary education earn seven times more than those with no education. Males with post-secondary education earn six times more than those without education. The earnings differential is more pronounced for female employees; where those with post-secondary education earn thirteen times more than those with no education at all. Compared to those reported in 1972 and 1986 (4.5 and 6.1 respectively), this ratios indicate an increase in earnings differentials between those with lower levels of education and those with higher levels of education[11].

The earnings differentiation by gender declines by level of education. For the illiterate and those with lower primary, male workers earn about twice more than female workers. However, for those with higher education and higher secondary, the ratio of earnings between male and female workers is about 1:1. To test for independence between average earnings by gender and education level we calculate a chi-square and compare it with the tabled value. The calculated Chi-square = 196.16[12]. The tabled value at 0.5% and 0.1% levels are as follows; $X^2_{5,\,0.005} = 16.75$; $X^2_{5,\,0.001} = 20.51$. Since these values are lower than the calculated chi-square, the null hypothesis of no association

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[11] See Kann, et al., 1988, pg. 104 for summary of the ratios for 1972 and 1986.

[12] The formula for chi-square is $X^2 = \sum_{i=1}^{6}\sum_{j=1}^{2} \frac{(O_{ij} - \hat{E}_{ij})^2}{\hat{E}_{ij}}$, where O_{ij} is the observed earnings, $\hat{E}$ is the calculated expected earnings, i is the number of columns and j is the number of rows.

between education levels and earnings by gender is clearly rejected even at the 0.1% level. This in other words means that there is dependence between average earnings by gender and education level. In fact, the earnings differentials between male and female workers decline as the education level rises.

Table 4.9 *Monthly earnings of workers by education levels (Pula): means, overall and by gender (HIES)*

School category	Overall	Male	Female
Illiterate	345.54	403.04	186.82
Lower Primary(1-4)	452.79	568.04	261.54
High Primary (5-7)	490.51	627.80	350.21
Low secondary(8-10)	843.10	1050.58	703.72
High Secondary(11-12)	1592.92	1699.81	1449.52
Higher education (13 plus)	2503.55	2516.69	2484.42

Table 4.10 shows monthly earnings of employees from the supplementary survey by education levels and gender. This initial description of earnings distribution shows that the most significant earnings differentials are due to education. Average earnings increase as the level of education increases. For all employees, those with post secondary education earn about 4.5 times more than those with no education at all. For male workers, they earn 4.7 more, while female employees with post-secondary earn seven times more than those females with no education. The earnings ratio between male and female employees decline as the level of education increases. It is about 1: 2 for the illiterate and those with primary education, and falls to about 1: 1.4 for those with

secondary and higher education. To test for independence between average earnings by gender and education level we calculate a chi-square and compare it with the tabled value. The calculated Chi-square = 67.35. The tabled value at 0.5% and 0.1% levels are as follows; $X^2_{5,\,0.005} = 16.75$; $X^2_{5,0.001} = 20.51$. Since these values are lower than the calculated chi-square, the null hypothesis of no association between education levels and earnings by gender is clearly rejected even at the 0.1% level. This means that there is dependence between average earnings by gender and education level. This is to be expected since earnings differentials by gender actually fall as the level of education rises.

The high average earnings of male workers as compared to female workers from both samples is due to differentiation of earnings between male and female workers with lower education. These results might be due to the fact that there is an increased supply of female workers with lower secondary and above, who might be pushing workers of lower education levels to lower paying jobs. If there is any earnings discrimination on gender basis, that is likely to be at the lower level of education, especially among the illiterate and lower primary school levels. This might also be due to differences in pay between jobs employing males versus females with lower education as there is likely to be a more strict division of labour on the basis of gender for the jobs performed by the less educated.

Table 4.10 *Monthly earnings of employees by education levels (Pula): means, overall and by gender (SS data)*

School category	Overall	Male	Female
Illiterate	598.87	664.30	296.25
Lower Primary (1-4)	568.69	668.49	363.60
Higher Primary (5-7)	577.24	684.29	413.58
Low secondary (8-10)	825.85	920.86	743.07
High secondary(11-12)	1295.47	1472.96	1085.12
Higher education(13 +)	2710.78	3144.46	2127.55

4.4.5 *Some characteristics of workers by location and gender*

Table 4.11 shows some characteristics of the workers in the sample from HIES by location. Table 4.12 shows t-values to test for significance in mean differences of characteristics between locations. The disaggregation of sample by location shows that the workers in the urban areas are on average more educated, followed by those in urban villages, and the least educated are those in the rural areas. Training and average earnings also follow the same pattern with higher averages being in the urban areas, followed by urban villages. These differences in mean earnings, training and education between locations are all significantly different from zero at 1% level. Differences in age between locations are not significant even at the 5% level. Rural workers have a significantly higher average potential experience than urban workers do in the sample. The mean differences in potential experience between urban villages and rural workers and between urban village workers and urban ones are not significantly different from zero at the 5% level.

The results from the analysis above imply that people with more human capital are likely to take a job in the urban area and less likely to locate in the villages. This could be a result of workers preferring the urban areas for some other benefits like better infrastructure, better school for their offspring's, better services, etc. It also may reflect that better jobs are found in the urban areas and the second best in the urban villages. Most highly paying companies are more likely to locate in the urban areas than the rural areas given the better infrastructure and sometimes higher demand for their products in the urban areas.

Table 4.11 *Characteristics of workers by location (Means)(HIES)*

Variable	Urban	UrbanVillages	Rural
Education	7.4	6.49	4.95
Age	33.14	33.72	34.55
Potential Experience	18.08	18.41	19.6
Training(yes=1,0 otherwise)	0.29	0.19	0.14
Mean Earnings	P887.80	P605.62	P411.57

Table 4.12 *t- values for some variables between locations (HIES)*

Variable	t-values-urban/ urban villages	t-values-Urban /Rural Areas	t-values-urban villages/rural Areas
Gross Income	11.03**	5.01**	16.31**
Age	1.37	-1.18	0.35
Potential Experience	-0.62	-1.6	-2.24*
Years of Schooling	8.42**	5.77**	12.58**
Training	7.38**	2.25*	8.93**

** Significantly different from zero at 1 % level of significance

* Significantly different from zero at 5% level of significance

Table 4.13 gives a summary of some of the characteristics of the sample from the supplementary survey by location and gender, while table 4.14 summarises significance tests of characteristics by location. This results differ very much from those obtained from the HIES sample. Urban village workers are on average a year older than the urban sample of workers. The difference in the mean age by gender is however not significant at 5% level of significance. The workers in the sample have an almost equal average of years of schooling for themselves and for the head of the household between locations. For all the workers combined differences in mean hours worked between locations are significant at at least 5 % level of significance. For female workers, differences in mean gross earnings and training are significant at 1% level of significance. For both urban villages and urban areas the female worker and female head of household have a higher average years of schooling than their male counterparts.

Urban village workers in the sample are slightly more experienced than the urban sample of workers, but that difference is however, not significantly different from zero at 5% level of significance. Urban workers on average work significantly more hours than those in the urban villages, with female ones working more hours than the male workers in both locations. On the other hand urban workers have a lower average earnings than those in urban villages despite their longer hours of work. However, for all the workers, the differences in earnings between locations are not significantly different from zero at 5% level of significance, though it is significantly different from zero at the 1% level for female workers alone between locations. A larger percentage of urban village workers are trained (44%) than the urban ones (36%). The difference in training between locations is significantly different from zero at 5% level of significance. In general, the sample of urban village workers and urban areas has almost similar characteristics. Significant differences are observed for average earnings, hours worked and training between female workers by location. None of the other characteristics are significantly different from zero at 5% level of significance for male workers by location. The supplementary survey data does not show any significant locational bias between urban and urban villages by workers given their human capital stocks.

Table 4.13 Characteristics *of workers by location and gender (SS Data)*

	URBAN			URBAN VILLAGES		
	All	Male	Female	All	Male	Female
Age	32.5	33.4	31.4	33.6	34.3	33.1
Ed.head	7.9	7.8	7.9	8.1	7.5	8.6
Eperien	9.2	10.8	7.5	9.9	11.2	8.8
Hours	194	190	201	183	182	184
School	8.1	7.9	8.2	8.2	7.5	8.9
training	.36	.37	.34	.44	.39	.48
gross Y	842.57	1037.20	627.27	912.94	1001.53	826.82

Table 4.14 *t- values by location, all workers and by gender (SS Data)*

Variable	t-values- All	t- values - male	t- values - female
Gross earnings	1.19	0.39	2.72**
Age	1.75	0.9	1.68
Experience	1.31	0.44	1.85
Years of Schooling	0.35	1.03	1.82
Education of head	0.47	0.76	1.56
Training	1.97*	0.3	2.49*
Hours worked	3.31**	1.73	2.92**

** Significantly different from zero at 1 % level of significance
* Significantly different from zero at 5% level of significance

Table 4.15 is a summary of some of the mean characteristics of the HIES sample by gender and location. Table 4.16 summarises t-values for testing significance in differences between mean values of characteristics of male and female workers in the sample for all the three locations. The results show that female workers are on average more educated than their male counterparts in all locations. The differences in these means are significantly different from zero at 1% level. Training also follows the same pattern, but the mean differences between males and females in the sample are only significantly different from zero at 5% level for those in the rural areas. Average earnings are higher for males in all locations with the largest difference being in the urban areas. The differences in mean earnings between male and female workers in the rural areas are however, not significant at 5% level, while they are significant at 1% for both the urban and urban village sample of workers. Male workers from the urban and rural samples are on average significantly older than female ones at at least 5% level. The differences in mean ages between male and female workers in the urban village sample are not significant at the 5% level. Male workers have a significantly higher potential experience than female ones at at least 5% level for the urban and rural samples of workers. The differences in potential experience between gender for the urban village sample of workers is not significantly different from zero at 5% level of significance.

In general, the results are similar to those obtained in the previous sections, with males earning more than females on average, despite the fact that females have a higher average of education than male workers. Lastly, differences in mean earnings between male and female workers in the rural areas are not significant.

Table 4.15 *Earnings, age, experience, and education by sex and location (HIES)*

Variable	Urban	Urban Village	*Rural*
Education:			
Male	6.18	5.79	4.09
Female	8.1	7.24	5.95
Potential			
Experience:	19.37	18.53	21.02
Male	16.4	18.26	17.95
Female			
Earnings:			
Male	995.85	670.08	443.11
Female	746.99	537.12	374.63
Age:			
Male	35	33.66	35.79
Female	32	33.76	33.08
Training:			
Male	0.28	0.17	0.11
Female	0.30	0.21	0.19

Table 4.16 *t- values for some variables between male and female workers by location (HIES)*

Variable	t-values-Male/ female- urban.	t-values-Male/ female-urbanvillage	t-values- male/ female Rural Areas.
Gross Income	8.84**	3.35**	1.77
Age	7.07**	-0.03	2.43*
Potential Experience	6.36**	0.34	2.53*
Years of Schooling	-3.26**	-4.69**	-4.08**
Training	0.49	-1.19	-2.25*

** Significantly different from zero at 1 % level of significance

* Significantly different from zero at 5% level of significance

4.4.6 *Some characteristics of the sample by type of employment and gender*

Table 4.17 gives a summary of sampled workers from the supplementary survey by type of employment and gender, i.e. whether the respondent is self-employed or dependently employed. Table 4.18 is a summary of the tests for significance of differences between means of some of the characteristics between employees and the self-employed. Self- employed respondents are on average much older than employees (38 years as compared to 32 of employees). This difference (as shown by the t-value in table 3.18) is significantly different from zero at 1% level of significance. Employees have a higher average of education of the head of the household and of their own education than the self-employed. These differences in means between the two types of workers are significant at 1% level of significance. Self-employed workers have a significantly higher average number of years of experience on the job than employees.

Disregarding some periods of unemployment, the fewer years of education for the self-employed could explain their higher average years of experience on the job, since they would have started working at an earlier age than employee respondents, who would have been schooling by then. As Dabos and Psacharopoulos observe, schooling and experience are negatively correlated (Dabos and Psacharopoulos, 1991). The higher number of years of experience is also explained by the fact that the self-employed are on average significantly older than employees.

For both employees and the self-employed, males have a higher average number of years of experience on the job than females. On average, self-employed workers work more hours than employees, and yet earn less than those in dependent employment. The difference between mean hours is significant at 1% level of significance, while that between mean earnings is significantly different from zero at 5% level of significance. However, the differences in mean earnings and mean hours worked between male employees and self-employed males are not significantly different from zero at 5% level of significance. For both employees and the self-employed, female respondents work longer hours than males, and yet they on average earn less than the male respondents. In general, females earn less on average than males, and yet they have higher average years of education than males. Lastly, a larger proportion of employees (38%) is trained compared to the self- employed (27%), a difference that is significantly different from zero at 1% level of significance.

It is clear that the differential in earnings between employees and the self-employed in the sample is due to the self-employed having fewer years of schooling and training, even though they have more experience on the job. Their jobs might also be less

rewarding, since some would have taken them as a last resort to finding a formal job. Differences in mean earnings is however, not significantly different from zero between male employees and self-employed females.

The higher education and higher earnings of the employees vis-à-vis the self-employed indicates that the screening role of education might be an important explanation of earnings variation in Botswana's labour market. Wolpin (1977) suggests that individuals employed in jobs in which it is possible to determine productivity at small costs should purchase less schooling than their equally skilled counterparts. We therefore expect the unscreened worker to acquire less schooling than the screened worker.

Table 4.17 *Characteristics of workers by type of employment and gender (SS Data)*

	EMPLOYEES			**SELF EMPLOYED**		
	All	Male	Female	All	Male	Female
Age	32	33	31	38	38	37
Educ.head	8.1	7.9	8.2	6.1	5.8	6.5
Experience	9	10.4	7.6	12.9	15.8	9.8
Hours	190	187	193	221	201	242
School	8.3	8.1	8.5	6.1	5.7	6.6
Training	.38	.39	.38	.27	.24	.30
Gross inc.	878.72	1050.73	694.50	638.45	827.45	423.33

Table 4.18 *t- values by type of employment, all workers and by gender (SS Data)*

Variable	t-values- All	t- values - male	t- values - female
Gross earnings	2.57**	1.43	3.41**
Age	5.27**	3.37**	4.4**
Experience	3.81**	3.29**	2.18*
Years of Schooling	5.54**	3.9**	4.08**
Education of head	4.79**	3.43**	3.38**
Training	2.35*	2.22*	1.09
Hours worked	3.76**	1.91	3.39**

** Significantly different from zero at 1 % level of significance
* Significantly different from zero at 5% level of significance

4.4.7 *Some characteristics of the sample by type of organisation*

The organisations in Botswana are classified as government, parastatals and the private sector. Republic of Botswana (1992) show that the largest employer was the private sector, accounting for 64 percent of total employment, followed by government (31%) and parastatals were the lowest accounting for 5% of total employment. Table 4.19 shows some of the worker's characteristics from our sample by type of organisation or firm; i.e., whether it's a privately owned organisation, whose motive is to make profits, or a public organisation. Table 4.20 shows t- values for some of the worker's characteristics between workers employed in the public and private sectors. The public sector employees are on average three years older than private sector employees. They also have higher average years of schooling, experience and a higher percentage of workers with some training (50%) as compared to 33% of the private sector. The differences in means for these four characteristics between public and private sector workers are significantly different from zero at 1% level of significance. For both public

and private sector, males are much older and much more experienced than females. On the other hand females are more educated and a higher percentage of them have some training than males for both sectors. However, on average, females earn less than males for both the private and public sector. All differences in means of characteristics between private and public sector workers are significantly different from zero at 1% level.

Private sector workers work significantly more hours on average and yet they earn much less than public sector workers. Female workers in the private sector work more hours than male workers, and yet they earn less than they do. In general, workers who earn less tend to work more hours on average than those who earn more income. The higher average earnings of public sector workers are explicable by their possessing more of the human capital stocks of schooling, experience and training than workers in the private sector. However, it is not certain whether the higher earnings in the public sector reflect the higher productivity of workers with more human capital stocks, or whether those human capital stocks are being merely used as screens without necessarily making public workers more productive than private sector workers. In other words, screening might be prevalent in Botswana's public sector. Further analysis on screening will be made. It is worth noting that the public sector is more attractive to workers compared to the private sector even without consideration for job security and other benefits in the public sector that are not measured in this model.

Table 4.19 *Characteristics of workers by ownership of organisation/ firm and gender (SS Data)*

	PRIVATE			PUBLIC		
	All	Male	Female	All	Male	Female
Age	31	32	29	34	34	33
Educ.head	7.5	7.1	8.2	9.4	9.2	9.6
Experience	8.4	9.7	6.6	10.5	11.3	9.7
Hours	196	198	200	169	170	168
School	7.8	7.3	8.4	9.5	9.1	9.9
training	.33	.32	.35	0.5	0.50	0.57
Gross inc.	736.54	822.76	624.48	1115.05	1230.74	992.44

Table 4.20 *t- values by ownership of organisation/ firm, public/private sectors, all workers and by gender (SS Data)*

Variable	t-values- All	t- values - male	t- values - female
Gross earnings	6.41**	4.54**	4.96**
Age	5.23**	2.85**	4.86**
Experience	4.09**	2.05*	4.46**
Years of Schooling	6.54**	4.58**	4.57**
Education of head	6.66**	5.21**	3.92**
Training	5.48**	3.44**	4.26**
Hours worked	9.84**	7.81**	6.03**

** Significantly different from zero at 1 % level of significance

* Significantly different from zero at 5% level of significance

Table 4.21 shows characteristics of the sample between Parastatals and the public sector. Table 4.22 gives a summary of the tests for significance of means between the public and parastatal sectors. The public sector sample of workers is on average older, has a higher average for schooling and experience and a higher average education of their head of household than Parastatal workers. Parastatal workers on the other hand work more hours on average, and a slightly higher percentage of them have some training, and earn more on average than public sector workers. Differences in means of all the variables between public and parastatal workers, except mean earnings are not significantly different from zero at 5% level of significance. For female workers, even the difference in mean earnings is not significantly different from zero at 5% level of significance. In the parastatal sector, both the male heads of the household and the male worker are more educated than their female counterpart. In the public sector, it is the female worker and female head of household who is slightly more educated than her male counterpart. These differences in means are also not significantly different from zero at 5% level of significance. In general, there is no significant difference in means between the sample from the public and parastatal sectors. The only variable that has a significant difference in the mean values between the two sectors is earnings, and it is mainly for differences in mean earnings between male workers. It is not surprising that the parastatals are very similar to government given that there has always been a lot of government control in these organisations. For instance, the old Incomes Policy provided that the wages in the parastatal organisations were supposed to be at par with those in government. Government also takes the responsibility of appointing Board of Directors of these organisations, usually from their own employees or politicians.

Table 4.21 *Characteristics of workers by ownership of organisation/ firm and gender (SS Data)*

	PARASTATALS			PUBLIC		
	All	Male	Female	All	Male	Female
Age	33	34	32	34	34	33
Educ.head	8.5	9.0	7.4	9.4	9.2	9.6
Experience	10.2	11.2	8.0	10.5	11.3	9.7
Hours	174	172	177	169	170	168
School	9.2	9.3	8.1	9.5	9.1	9.9
training	.52	.48	.60	0.5	0.50	0.57
Gross inc.	1567.55	1833.22	933.72	1115.05	1230.74	992.44

Table 4.22 *t- values by ownership of organisation/ firm, Public/Parastatals, all workers and by gender (SS Data)*

Variable	t-values- All	t- values - male	t- values - female
Gross earnings	2.25*	2.13*	0.01
Age	0.71	0.23	101
Experience	0.32	0.05	1.37
Years of Schooling	0.61	0.27	1.25
Education of head	1.62	0.35	2.44*
Training	0.27	0.23	0.23
Hours worked	1.55	0.57	1.51

** Significantly different from zero at 1 % level of significance

* Significantly different from zero at 5% level of significance

4.4.8 *Earnings by Education Level and Type of Organisation*

Table 4.23 shows average earnings by level of education and whether the worker is a public or private sector employee. Average earnings increase as the level of education increase. Except for the illiterate, public sector employees, on average earn more than private sector employees at all education levels. Earnings ratios between those with no education and those with post secondary education are slightly higher between public employees. Results from Kann, et al. (1988) show that for no education and primary education average salary was higher in government, whereas for secondary and tertiary education private sector paid a higher salary. The higher wages and salaries of government for those with secondary and tertiary education than the private sector in the present study reflect two things. Firstly, the "decompression" exercise of 1990 increased government salaries for higher level workers quite significantly. Secondly, due to the relative abundance of graduates from secondary and tertiary levels of education, the private sector no longer needs to pay higher wages than government in order to attract them to its employment.

On the basis of gender, it is the female workers that have higher ratios for both sectors. The ratio is significantly larger between the private sector female employees (1: 12 compared to 1: 4 for male employees). Earnings are therefore highly differentiated between female employees than between male workers.

For both public and private sector employees, the earnings ratio between male and female workers decline as the education level increases. To test for independence between earnings by gender and education level we calculated X^2 for the both the public sector and the private sector. The calculated X^2 for the private sector is 293.7 and that of

the public sector is 118.92. Both calculated X^2 figures are greater than the tabled value at 0.1% level (20.51). For both the private sector and public sector employees there is no independence between earnings by gender and education level. Earnings differentials between male and female workers are higher at lower education levels and become narrower at higher levels of education. That implies that in fact earnings differentials between male and female employees are equalised as education levels increase. This is more pronounced in the private sector.

Table 4.23 *Earnings by level of education, by sector and gender (SS Data)*

	PRIVATE EMPLOYEES			PUBLIC EMPLOYEES		
	All	Male	Female	All	Male	Female
Illiterate	608.41	658.21	210	584.56	675.54	348
lowPrim	535.12	609.71	303.90	667	972.17	438.13
highprim	526.28	622.03	402.5	704.98	808.91	454.80
lowsec	668.78	774.12	577.32	1023.63	1104.86	952.57
highsec	1265.32	1395.36	1088	1319.23	1541.44	1083.14
higher	2416.05	2364.25	2485.11	2842.46	3491.22	1966.65

The results from the previous sections indicate that earnings are differentiated by various characteristics of the sampled workers. First, earnings differentials are due to differences in education between sampled workers, with earnings rising as the education level rises. Earnings are also differentiated by sector of employment. The public sector offers higher pay packages relative to the private sector. Sharp differentials are also observed between male and female workers. On average, female workers earn about 65% of what male workers earn. This differential is not observed uniformly at all levels of

education; the earnings differential diminishes as the education level increases. Earnings differentials are also due to the type of employment, i.e. whether the worker is in dependent employment or self-employment. Those in self- employment earn about 72% of those in dependent employment. This differential is more pronounced between female workers across the two types of employment. Lastly, earnings are also differentiated by whether one has had some training or not. Those with some training earn about twice the earnings of those without any training (P618.92 for those without training and P1250.59 for those with some training). If we compare earnings of those with no training with those whose training is related to the job they are doing, the earnings differentials between the two groups increase slightly. This would suggest that those with training related to the job they are doing are rewarded slightly more because of the enhancement in productivity. However, training might be highly correlated to the level of schooling, and therefore the earnings differentials might mainly be due to differences in schooling between the two groups. More analysis on this issue is done in the following chapter using the regression analysis.

4.5 SOURCES OF EARNINGS DIFFERENTIALS

In this section we make further analysis of earnings differentiation using the Mincerian earnings function. The dependent variable is natural log of net earnings, where net earnings are defined as gross earnings less tax. Gross earnings are defined as cash earnings plus wages in kind. Earnings are the money plus in-kind payments reported for the month preceding the survey period, i.e.

(1) Gross earnings = gross wage or salary + car allowance + back pay/ bonus/overtime + other allowances + value of wages in kind (mealie meal, other food, clothing, blankets, other goods). (1).

For the self employed a major form of earnings are profits. We therefore could not determine the share of labour from profits of the self-employed for the HIES data. For the supplementary survey data we had asked the respondents to estimate the money payments they would have paid themselves from the profits. We therefore use that figure to estimate the earnings to labour for the self-employed.

Another important variable in the Mincerian earnings function is experience or on the job training. For the HIES data this is approximated in the usual way as Age - years of schooling - 7 for those with education higher than 7 years of schooling, and Age - 14 for those with education of 7 or less years. The Age - 14 is a correction aimed at avoiding overestimating potential experience for those with fewer years of education[13]. The supplementary survey data has the actual number of years of experience reported by the respondent.

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[13] See Dougherty and Jimenez (1991) for further discussion on this correction.

4.5.1 *Earnings function, all and by gender*

Table 4.24 summarises the basic earnings function using the HIES data. Education is presented as continuos years. The column labelled (a) presents results of the basic Mincerian earnings function, with education, experience and its square as the only dependent variable. All the coefficients are significant at 1% level of significance and have the right signs. The model explains 38% of the variation in the earnings. The explanatory power of the model is quite robust and is quite comparable if not slightly better than some of the results that used this basic earnings function on developing countries; for instance Kugler and Psacharopoulos: 1989; Psacharopoulos and Steire: 1988; Al-Qudsi: 1989. The education coefficient, which is also the average rate of return to education is 16%. Experience adds positively to earnings until 38 years on the job beyond which it contributes negatively to earnings[14].

The second column labelled (b) adds a dummy variable for training which takes the value of 1 if the person has received training and zero otherwise. Adding this variable increases the explanatory power of the model substantially to explaining 45% of the variations in earnings. All the coefficients still have the right signs and are significant at 1% level of significance. The rate of return is reduced to 12%, and experience also peaks a year earlier than in the model without training.

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[14] The point where experience stops adding positively to earnings is defined by $\frac{\partial LnY}{\partial X} = 0$, from the earnings function; $LnY = a + bS + cX + dX^2$. This is equal to $\frac{c}{-2d}$; $d < 0$.

The last column explores the possibility that there might be a relationship between schooling and training, in particular that the more educated might also be the once likely to be having some training. A multiplicative interactive term between school and training is therefore introduced. The results of this modification are a slight increase in the R squared to 46% and a further reduction of the average rate of return to 11%. All coefficients are still significant at 1% level of significance and have the right signs. As expected, the coefficient of the interactive term is positive showing that those with more schooling tend to be the ones most likely to also have some form of training. Therefore, training has a significant independent influence on earnings, independent of schooling.

Table 4.24 *Mincerian earnings function: overall (HIES)*[Ψ]

Dependent variable (ln monthly earnings)

Variable	(a)	(b)	(c)
Constant	4.19 (68.07)	4.46 (75.28)	4.49 (75.61)
Education	0.16 (41.05)**	0.12 (27.4)**	0.11 (23.8)**
Experience	0.067 (14.04)**	0.055 (12.2)**	0.059 (12.71)**
Experience Squared	-0.00088 (-8.7)**	-00073 (-7.6)**	-0.00079 (-8)**
Training	_____	0.736 (19.3)**	0.23 (2.5)**
Training x Education	_____	_____	0.05 (5.4)**
R^2 (Adjusted)	0.38	0.45	0.46
Sample Size (N)	2891	2891	2891

Ψ Note: t-statistics in parenthesis

**Significant at 1% level of significance

* Significant at 5% level of significance

The results presented in table 4.24 are however potentially subject to a type of selection bias. The results are based on an equation estimated from data from only those

who were working resulting in a censored sample of the population. The problem is that the unobserved wage offers of those not working are probably lower than those for persons in the sample. To correct for this we use the Heckman's technique. This involves a two-step process in which in the first step the probability that an individual will be gainfully employed and out of school is determined according to a probit regression equation in which a series of personal characteristics serve as regressors. These are age, education and marital status. The probit results are reported in the appendix tables. From this probit equation a selection variable, the Inverse Mills Ratio is created and inserted into the right hand side of the earning function. That equation is then re-estimated for those employed to yield estimates free of censoring bias. The sample selection terms also provide an insight into the relationship between the error terms in the earnings equations and the probit equation. The negative value of the selectivity term's coefficient implies that the error terms in the probit and revised earnings equations are negatively related.

The inclusion of the selectivity term in the revised wage equation, however, introduces heteroscedasticity. This is because the variance of the error term in the revised wage equation is dependent on the selectivity term. To correct the estimates for heteroscedasticity we use White (1980) Heteroscedasticity-Consistent variance-covariance matrix estimation[15].

The results for the corrected estimates are reported in table 4.25 below. The results of this correction are that the average rate of return (which is the expected average rate of return) is lower by four percent (basic earnings function) and three percent for the

[15] See White (1980, 1993) for this correction for heteroscedastcity.

other two specifications of the model. The explanatory power of the model also improves significantly, especially for the basic earnings function. Experience becomes significant in the last two specifications of the model. It is also noteworthy that the inverse mill term is negative and significant even at the 0.1 percent level. The negative coefficient of the selectivity term implies that observed wages are lower than the wage offers of a random sample. In other words, those individuals who are less productive in terms of unobservable characteristics are more likely to be included in the sample of workers. This might mean that those who do not participate take a longer-term view of their labour market commitment.

Table 4.25 *Mincerian earnings function: overall- corrected for censoring bias (HIES)* $^{\Psi}$

Dependent variable (ln monthly earnings)

Variable	(a)	(b)	(c)
Constant	5.7 (47.1)	5.5 (47.2)	5.5 (42.9)
Education	0.12 (26.5)**	0.096 (19.4)**	0.095 (19.06)**
Experience	0.009 (1.5)	0.014 (2.4)*	0.017 (2.6)**
Experience Squared	-0.00012 (-1.1)	-00018 (-1.7)	-0.00022 (-1.98)*
Training	_____	0.6 (17.4)**	0.5 (4.8)**
Training x Education	_____	_____	0.013 (1.4)
Inverse Mills Ratio	-1.3(-14.9)**	-0.98(-11.2)**	-0.9(-9.2)**
R^2 (Adjusted)	0.41	0.47	0.47
Sample Size (N)	2891	2891	2891

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

In table 4.26 we fit the Simple Mincerian earnings function with continuous education between male and female workers using HIES data. The (b) parts of the table

shows the results that are adjusted for censoring bias with the inclusion of an Inverse Mills Ratio as discussed earlier. The results in the (a) parts show that the model has a better explanatory power for females with an R squared of 48% when fitted on female workers for male workers. All coefficients are significant at 1% level of significance and have the right signs for both sexes. Females have a higher average rate of return of 21% than that of males, which is 14.5%. These paradoxical results are observed in most studies and are attributed to the lower forgone earnings of females as compared to their male counterparts (see for instance Psacharopoulos and Alam: 1991; Gomez-Castellanos and Psacharopoulos: 1990; Psacharopoulos, Velez and Patrinos: 1994; Kugler and Psacharopoulos: 1989). The high private rates of return to females also explain why females have a higher demand for education than males as evident from their higher average years of education. Experience contributes positively to earnings up to 36 years on the job for females and 33 years for males.

The earnings functions adjusted for censoring bias present very similar effect to the model as in table 4.25. The most significant changes are the lowering of the average rate of return by about four percent and an improvement in the explanatory power of the model. The Inverse Mills Ratio is also significant at the 0.1% level.

Table 4.27 is a summary of a Mincerian earnings function with a dummy variable for sex equal to 1 for males and 0 for females. We also add an interactive term for education and gender. The column labelled B presents results that are based on an earnings function that is corrected for sample selection bias. All coefficients are significant at the 1% level. The coefficient for the dummy for sex is positive, implying that being male increases your earnings versus those of females. The coefficient of the

interactive term is negative; implying that males are likely to be less educated than female workers, ceteris paribus. These results indicate to what we have already established; that females tend to be more educated than their male counterparts and yet earn less than their male counterparts. The actual and expected average rates of return to females are significantly higher at 21% and 18% (these are actually the coefficients for the education variable in table 4.26).

In table 4.28 we add training and an interactive variable for training and schooling. For both the model corrected for censoring bias (columns B) and those not corrected for the bias, the explanatory power of the model for both males and females increases quite substantially. The model explains about 50% for male population and about 56% for female workers. All coefficients are still significant at 1% level of significance and have the right signs, except for the coefficient for training for male workers, which, even though still significant, it is only significant at the 5% level. The inverse mills ratio is still significant at the 0.1 percent level. The average rate of return to education is reduced by about three percent for males and about four percent for female workers. Experience peaks one year earlier for both sexes as compared to the model without training and its interactive.

Table 4.26 *Mincerian earnings function by gender (HIES)*[Ψ]

Dependent variable (ln monthly earnings)

Variable	Male (a)	male (b)	Female (a)	Female (b)
Constant	4.36 (61.8)	5.67(42.1)	3.5 (36.01)	4.8(26.3)
Education	0.145 (33.8)**	0.12(22.4)**	0.21 (34.1)**	0.18(22.9)**
Experience	0.087 (15.2)**	0.037(5.4)**	0.069 (9.5)**	0.018(2.08)*
Experience Squared	-0.0013 (-10.9)**	-0.0006(-4.8)**	-0.00096 (-5.9)**	-0.0003(-2)*
Inverse Mills Ratio		-1.29(-11.3)**		-0.98(-9)**
R^2 (Adjusted)	0.44	0.47	0.48	0.51
Sample Size (N)	1587	1587	1304	1304

Ψ Note: t-statistics in parenthesis. Columns labelled (b) are corrected for censoring bias
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 4.27 *Mincerian earnings function with dummy for gender.(HIES)*[Ψ]

Dependent variable (ln monthly earnings)

Variable	A	B
Constant	3.3 (47.6)	4.7(38.2)
Education	0.21 (38.7)**	0.18(28.8)**
Experience	0.079 (17.7)**	0.027(4.9)**
Experience Squared	-0.00116 (-12.1)**	-0.00046(-4.5)**
Sex (1=male, 0 otherwise)	1.1 (20.16)**	1.02(18.4)**
Sex x Education	-0.074 (-11)**	-0.065(-10.2)**
Inverse Mills Ratio		-1.14(-14)**
R^2 (Adjusted)	0.48	0.51
Sample Size (N)	2891	2891

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance

Table 4.28 *Mincerian earnings function by gender, with training and an interactive term (HIES)*[Ψ]

Variable	(A) Male	(B) Male	(A) Female	(B) Female
Constant	4.5 (65.8)	5.5(39.1)	3.8 (41.64)	4.7(27.4)
Education	0.11 (20.9)**	0.096(17.2)**	0.15 (22.8)**	0.14(17.1)**
Experience	0.078 (14.12)**	0.04(5.6)**	0.057 (8.4)**	0.02(2.8)**
Experience Squared	-0.0012(-10.2)**	-0.00065(-5)**	-0.0008 (-5.4)**	-0.00039(-2.6)**
Training	0.23 (2.2)*	0.41(3.6)**	0.66 (8.7)**	0.65(11.3)**
Training x School	0.036 (3.6)**	0.007(0.6)	0.0089(1.5)	0.005(2.6)**
Inverse Mills Ratio		-0.99(-7.7)**		-0.66(-6.4)**
R^2 (Adjusted)	0.49	0.51	0.56	0.57
Sample Size (N)	1587	1587	1304	1304

Ψ Note: t-statistics in parenthesis. Columns labelled (B) are corrected for censoring bias

**Significant at 1% level of significance

* Significant at 5% level of significance

Table 4.29 presents the basic Mincerian earnings function to the supplementary survey data, with the column labelled (a) adding training and (c) adding an interactive term between training and schooling. The last column is to investigate the issue that those with more schooling might at the same time be the ones with training as already discussed in the last section. The results from (a) show that the private rate of return to education is 12%. The variables education and experience have explanatory power in the model because their coefficients are significant at 1% level of significance. The model explains 47% of the variation in earnings. This is slightly better than what was obtained from the HIES data. The coefficient of experience and its square imply that earnings grow at 8% annually in the beginning of working life and decrease continuously until they reach zero growth after 29 years of experience; thereafter, earnings growth becomes

negative until retirement. Adding training increases the explanatory power of the model by four percentage points. The schooling and training interactive term has a positive coefficient, which is significant at the 5% level. These results suggest that those with more schooling tend to be the ones likely to have some training. The coefficient of training is not significant at 5% level for this specification of the model. The average rate of return to education is slightly reduced by two percentage points to 10%.

Table 4.30 presents results of a basic Mincerian Earnings function by gender to the supplementary survey data. Education, experience and its square are the only independent variables. The model has a better explanatory power when fitted on females with an R square of 55% as compared to 44% for one on male workers. All the coefficients of the variables are significant at 1% level of significance for females and also have the right signs. For male workers, the coefficients for education and experience are significant at 1% level of significance. For male workers, however, the coefficient for the square of experience is not significant at the 5% level. Experience adds positively to earnings up to 50 years of experience for males and 20 for females. What this means is that earnings of male workers will continue to grow because of experience on the job up to 50 years on the job, while for female workers, earnings could peak as early as 20 years of working on the job. The impact of experience for females is more important than it is for males. Female workers have a higher average rate of return to education of 15%. Male workers are 4 percentage points lower with a rate of 11%.

Table 4.30, last column also presents a Mincerian earnings function with a dummy variable for sex equal to 1 for females and 0 for males and an interactive for education and gender. All coefficients are significant at the 1% level. The coefficient for

the dummy for sex is negative, implying that being female lowers your earnings versus those of males. The coefficient of the interactive term is positive, implying that females are likely to be more educated than male workers, ceteris paribus. These results indicate to what we have already established; that females tend to be more educated than their male counterparts and yet earn less than their male counterparts. The average rate of return to males is significantly lower at 11%. With the exception of experience on the job, the results obtained from table 4.30 are very similar to those obtained from the HIES data in terms of trend (refer to tables 4.26 and 4.27 of HIES data). The rates of return figures are however lower than those obtained from HIES data, even though the model has better explanatory power for female employees.

Table 4.29 *Basic Mincerian Earnings Function, employees and self employed, Overall* (SS data)[Ψ]

Variable	(a)	(b)	(c)
Constant	4.9 (79.7)	4.9(83.3)	5.0 (72.9)
Education	0.12 (24.3)**	0.11 (20.)**	0.10 (14.7)**
Experience	0.08 (10.5)**	0.077(10.2)**	0.075 (9.7)**
Experience Squared	-0.0014(-5.1)**	-0.0014(-5.3)**	-0.0013(-4.8)**
Training		0.34(8.7)**	0.14(1.4)
Training x education			0.022(2.1)*
R square (Adjusted)	0.47	0.51	0.51
N	1026	1026	1026

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 4.30 *Basic Mincerian Earnings Function, employees, by Gender and All* (SS)$^{\Psi}$

Dependent Variable (Log of net monthly earnings)

Variable	Male	Female	All
Constant	5.3 (67.5)	4.4 (51.8)	5.2 (78.4)
Education	0.11 (17.8)**	0.15 (20.2)**	0.11 (18.1)**
Experience	0.05 (5.0)**	0.010 (9.7)**	0.078 (11.8)**
Experience Squared	-0.0005 (-1.6)	-0.0025 (-6.0)**	-0.0016 (-7.4)**
Sex(male=0, female=1)	_____	_____	-0.75 (-8.6)**
Sex * Education	_____	_____	0.04 (4.5)**
R square (Adjusted)	0.44	0.55	0.51
N	532	494	1026

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

4.5.2 *Earnings Functions by Location of Workers*

Table 4.31 shows results of fitting a basic Mincerian earnings function by location of employees to HIES data. For all the three locations, the explanatory power of the model is quite robust. The coefficients for years of education and experience are significant at the 1% level for all the three locations. Experience is more important in the rural areas, followed by the urban areas, and least important in the urban villages. In fact the coefficient for the square of experience is not significant at the 1% level for the urban village workers. The average rate of return is equalised at 14% between the urban areas and urban villages, but 2 percentage points higher for the rural workers. This suggests that education is more rewarding on average to the rural worker. The evidence also

suggests that there is no labour market segmentation between the urban and urban village's labour markets.

Table 4.32 presents results that are corrected for selection bias using Heckman's (1976) technique as discussed previously. This correction results in lower average rates of returns for all locations. The biggest decrease is with the rural areas whose rates are now equalised with the other two locations at 11 percent. Experience and the square of experience become insignificant after this correction. The explanatory power of the model improves quite substantially for the urban and urban villages while the explanatory power of the model falls for the rural areas. The inverse Mills ratios are also still significant at the 0.1 percent level.

Table 4.31. *Basic Mincerian Earnings Function, Urban villages, urban areas and Rural areas (HIES)*[Ψ]

Variable	Urban	Urban Villages	Rural Areas
Constant	4.4 (54.4)	4.5 (38.6)	3.7(25.3)
Education	0.14 (29.2)**	0.14 (18.6)**	0.17(16.9)**
Experience	0.068 (11.01)**	0.039 (4.1)**	0.069(5.6)**
Experience Square	-0.0008 (-6.5)**	-0.0003 (-1.6)	-0.00098(-4.0)**
R square (Adjusted)	0.34	0.31	0.42
N	1728	758	405

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 4.32. *Basic Mincerian Earnings Function with correction for censoring bias, Urban villages, urban areas and Rural areas (HIES)*[Ψ]

Variable	Urban	Urban Villages	Rural Areas
Constant	5.8 (41.7)	5.75 (876)	5.9(41.7)
Education	0.11 (22.4)**	0.11 (14.3)**	0.11(22.4**
Experience	0.024 (0.28)	0.029 (0.8)	0.0024(0.28)
Experience Square	-0.0004 (-0.2)	-0.0003 (-1.6)	-0.00044(-0.2)
Inverse Mills ratio	-1.5(-13.6)**	-0.9(-7.8)**	-1.5(-13.6)**
R square (Adjusted)	0.40	0.35	0.40
N	1728	758	405

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

The next table (table 4.33) shows results of fitting a basic Mincerian earnings function for urban villages and urban areas separately using the supplementary survey data. The columns labelled B are corrected for choice of location by the inclusion of an Inverse Mills Ratio. This is created from a probit that has the choice of location as the dependent variable regressed against age school gender and marital status. The results of the probit equation are shown in the appendix.

The results from the columns A (not corrected for location bias) are very similar to the ones obtained from the HIES data. For both locations, the explanatory power of the model is quite robust. The coefficients of experience and education are significant at 1% level of significance for both urban areas and urban villages. The coefficient for the square of experience is however, not significant for the urban villages. Experience is

more important in determining earnings for the urban area than the urban village. Lastly, the average rate of return to education is equalised between locations at 12%. This evidence suggests that there is no labour segmentation between urban areas and urban village's labour markets. This implies that workers with similar human capital characteristics are not rewarded differently depending on the segment of the labour market in which they happen to be located. The results from fitting an earnings function with correction for location bias are very similar to those without the correction. The inverse mills ratio for the model fitted on urban areas is significant at the 1 percent level, while that of the model fitted on the urban villages is not significant at the 5% level. The significant and positive coefficient of the selectivity term implies that those who choose to work in the urban areas have a comparative advantage in terms of the unobserved characteristics.

Table 4.33. *Basic Mincerian Earnings Function, Urban villages and urban areas (SS Data)*[Ψ]

Variable	Urban(A)	Urban(B)	Urban Villages(A)	Urban Villages(B
Constant	4.8 (70.4)	4.5(40.4)	5.06 (37.4)	5.7(16.4)
Education	0.12 (20.9)**	0.12(15.4)**	0.12 (12.3)**	0.12(13.5)**
Experience	0.086 (9.8)**	0.08(8.4)**	0.06 (3.5)**	0.059(3.6)**
Experience Square	-0.0015 (-4.9)**	-0.0016(-4.2)**	-0.0008 (-1.3)	-0.00089(-1.5)
Inverse Mills Ratio		1.08(3.5)**		-0.45(-1.9)
R square (Adjusted)	0.46	0.47	0.48	0.49
N	736	736	198	198

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 4.34 is very similar to 4.33 except that we now add training, logarithm of hours worked and family background variable as measured by the education of the father to the basic earnings function. The columns B are those corrected for choice of location bias. All coefficients are significant at 1% level of significance for the urban areas and the explanatory power of the model improves quite substantially for both locations. The coefficients of Logarithm of hours worked, square of experience, and education of the father are not significant at 5% level of significance for the urban villages. Experience and training are rewarded more in the urban areas than in the urban villages. The average rate of return for the urban villages is now one percentage point higher than that of urban areas. There are no fundamental changes from correcting for choice between urban and urban areas.

Table 4.34. *Basic Mincerian Earnings Function by location, hours, training and family background (SS data)*[Ψ]

Variable	Urban(A)	Urban(B)	Urban Villages(A)	Urban Villages(B)
Constant	6.03 (14.5)	5.7(10.8)	6.8 (7.3)	7.5(6.6)
Education	0.09 (15.7)**	0.09(11.6)**	0.10 (9.3)**	0.10(9.6)**
Experience	0.08 (9.6)**	0.077(8.3)**	0.055 (3.2)**	0.053(3.4)**
Training	0.35 (8.1)**	0.34(7.9)**	0.25 (2.9)**	0.23(2.9)**
Log Hours	-0.22 (-2.8)**	-0.19(2.1)*	-0.33 (-1.9)	-0.34(-1.6)
Education of Father	0.016 (2.7)**	0.016(2.6)**	0.016 (1.1)	0.015(1.14)
Experience Square	-0.0015 (-5.08)**	-0.0015(-4.3)**	-0.0007 (-1.2)	-0.00079(-1.4)
Inverse Mills Ratio		0.76(2.7)**		-0.38(-1.8)
R square (Adjusted)	0.52	0.52	0.52	0.52
N	736	736	198	198

Ψ Note: t-statistics in parenthesis

**Significant at 1% level of significance

* Significant at 5% level of significance

4.5.3 *Earnings function by type of employment*

Table 4.35 shows the results of fitting the earnings function for the self-employed and employees. The B columns show results of the earnings function with correction for choice of employment. The coefficients for education and experience are significant at 1% level of significance and have the right signs for employees. For the self-employed, The coefficient for education is significant at 1% level of significance, while that of experience is only significant at 5% level of significance. The results indicate that experience is more important for employees than for the self employed. The model also explains better the variations in earnings for employees (R square of 47%) than the self

employed (R square of 23%). The coefficient of the square of experience is not significant for the self-employed. Even though the self-employed have more years of experience as shown in table 4.17, the results from table 4.35 suggest that experience is not that important in determining wages for the self-employed group. The average rate of return to education is just one percentage point higher for employees than the self-employed. This suggests that although sector of employment is a critical determinant of earnings, this variable has a less clear-cut impact on the rate of return to education. In fact formal education is almost equally rewarding between the self-employed and employees. Dabos and Psacharopoulos (1991) report very similar results for the Brazilian economy. The correction for choice of employment has no fundamental effect on the results of the employee workers. For the self-employed, however, the average rate of return is reduced slightly by about 2%, but the inverse mills ratio is not significant at the 5% level.

Table 4.35. *Basic Mincerian Earnings Function, employees and self employed, All (SS)* $^{\Psi}$

Dependent Variable (Log of net monthly earnings)

Variable	Employees(A)	Employees(B)	Self-employed(A)	Self-employed(B)
Constant	4.9 (79.7)	4.99(50.1)	4.8 (18.2)	4.1(6.9)
Education	0.12 (24.3)**	0.12(14.89)**	0.11 (4.3)**	0.089(2.58)**
Experience	0.08 (10.5)**	0.084(9.5)**	0.06 (2.4)*	0.069(3.3)**
Experience Squared	-0.0014(-5.1)**	-0.0014(-4)**	-0.0012 (-1.8)	-0.0011(-2.6)**
Inverse Mills Ratio		-0.47(-2)*		0.43(1.5)
R square (Adjusted)	0.47	0.47	0.23	0.24
N	934	934	92	92

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

4.5.4 *Family background and Hours worked*

Table 4.36 is similar to table 4.26, except that we now add hours of work and family background variables. Family background is approximated by the education of the head of the household. For all employees, all coefficients are significant at 1% level of significance, and the explanatory power of the model improves slightly by one percentage point. Experience is still more important for female than male workers; in fact the square of experience remains unimportant for male workers with this specification of the model. The coefficient of the education of the head of the household is only significant for male employees at 1% level of significance. The average private rate of return is reduced and is quite a big decrease for male employees, where it falls from 11% to only 3% with this specification.

The meaning of a positive significant coefficient to a family background variable is that suggest that family background is important in determination of earnings. This enters in two ways; one through provision of a better learning environment and second from better contact about good jobs in the labour market. Given that unemployment is quite high, especially for primary and lower secondary education graduates, it is very likely that family contacts are becoming an important way of learning about a good job. Those with more educated parents are more likely to get better information about jobs and therefore obtain better paying jobs.

Hours of work have a paradoxical negative coefficient for both male and female workers. This seems to suggest that those who supply more hours tend to earn less on average.

Table 4.36. *Mincerian Earnings Function with log hours and family background variables, employees only (SS data)*[Ψ]

Variable	All	Male	Female
Constant	6.4 (16.4)	6.8 (11.2)	5.6 (12.3)
Education	0.08 (7.6)**	0.033 (2.2)*	0.14 (10.1)**
Experience	0.079 (10.3)**	0.049 (5.1)**	0.01 (9.4)**
Experience Square	-0.0014 (-4.9)**	-0.00005 (-1.5)	-0.0024 (-5.9)**
Log hours	-0.289 (-3.9)**	-0.27 (-2.4)*	-0.23 (-2.8)**
Education of head	0.04 (3.9)**	0.079 (5.5)**	0.0079 (0.6)
R square (Adjusted)	0.48	0.49	0.55
N	1026	532	494

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 4.37 compares the self-employed and employees after adding log of hours and education of head of the household. The average rate of return to education is now higher for the employees than for the self-employees. The coefficient of the logarithm of hours supplied has the right sign for the self-employed, but it is not significant at 5% level of significance. The coefficient of the education of the head of the household is significant at 1% level of significance for employees and 5% level of significance for the self-employed sample of workers. But with the correction for choice of employment and heteroskedasticity, it is not significant for the employees at the 5% level. The positive coefficient suggests that those whose heads of households are more educated tend to earn significantly more in the labour market.

Table 4.37 *Mincerian Earnings Function with log hours and family background variables, employees and self-employed (SS data)*[Ψ]

Variable	Employees (A)	Employed(B)	Self Employed(A)	Self-Employed(B)
Constant	6.4 (16.4)	6.5(12.8)	4.1 (3.3)	3.5(3.4)
Education	0.08 (7.6)**	0.7(4.08)**	0.04 (0.9)	0.02(0.5)
Experience	0.079 (10.3)**	0.08(9.3)	0.055 (2.1)*	0.063(2.9)**
Experience Square	-0.001 (-4.9)**	-0.0013(-3.7)**	-0.00099 (-1.5)	-0.001(-2.1)*
Log hours	-0.289 (-3.9)**	-0.28(-3.2)**	0.12 (0.5)	0.11(0.5)
Education of head	0.04 (3.9)**	0.041(2.6)	0.083 (2.08)*	0.08(2.2)*
Inverse Mills Ratio		-0.5(-2.3)**		0.4(1.1)
R square (Adjusted)	0.48	0.49	0.27	0.28
N	934	934	92	92

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Two other family background variables are added to the model for both employees and the self-employed. These are the education of the father and the education of the mother. The coefficients of these two variables are individually not significant for the self-employed. This suggests that among the self-employed, family background as measured by either the father's education or the mother's is not a significant determinant of earnings. The coefficient for education of the father is also negative. This might reflect a fact that family contacts are less important for getting a self-employment job.

For employees, it is only the coefficient of the father's education that is significant at 1% level of significance. The coefficient of this variable is positive, suggesting that those whose fathers have more education earn significantly more in the labour market. The results of this analysis are presented in table 4.38 below (mother's

education variable is not shown in this table). The introduction of family background variables for employees has a tendency to reduce the estimated effects of the son's or daughter's own education on earnings, hence the rate of return to their education. This evidence suggests that a part of the estimated effect of one's own education on earnings from regressions that do not control for family background is due to parental influence on earnings. Table 4.39 shows that earnings rise with family background variable. Those workers whose fathers have more education earn significantly more in the labour market. This is partly due to the fact that they have attained a high level of schooling than those workers whose fathers are less educated and most probably due to better contacts about jobs in the labour market. Experience generally decreases as the father's education increase, which is consistent with the finding that schooling and experience are negatively related.

The significant positive relationship between earnings and family background as measured by fathers' education and education of the head of household suggests that earnings rise with improvement in family background. The meaning of these findings is unfortunately, ambiguous. Radical economists use such evidence to argue that society is stratified along class lines. Neo-classical economists argue that background variables proxy the quality of the learning environment when the child is young. Unfortunately, it is not possible to distinguish between these competing hypotheses with cross-section data of the type at our disposal.

Table 4.38 *Mincerian Earnings Function with log hours and family background variables (SS data)*[Ψ]

Variable	Employees (A)	Employees (B)	Self Employed (A)	Self-employed (B)
Constant	6.3 (16.4)	6.5(12.7)	3.96 (3.2)	3.2(3.05
Education	0.11 (22.3)**	0.11(13.7)**	0.12 (4.4)**	0.09(2.8)**
Experience	0.08 (10.4)**	0.08(9.4)**	0.066 (2.3)*	0.07(3.4)**
Experience Square	-0.0014 (-5.)**	-0.0013(-3.9)**	-0.0012 (-1.8)	-0.0012(-2.8)**
Log hours	-0.27 (-3.7)**	-0.28(-3)**	0.16 (0.73)	0.16(1)
Education of father	0.013 (-3.7)**	0.012(2.2)*	-0.03 (-.93)	-0.38(-1.3)
Inverse Mills ratio		-0.45(-1.969)*		0.48(1.3)
R square (Adjusted)	0.48	0.48	0.24	0.26
N	934	934	92	92

Ψ Note: t-statistics in parenthesis

**Significant at 1% level of significance

* Significant at 5% level of significance

Table 4.39. *Earnings, education and experience by education of father* (SS data)

	FATHER'S EDUCATION				
Variable	No Educ.	Primary	Low Sec.	High Sec.	Higher
Earnings	820.21	866.92	1202.36	1503.44	2651.78
Education	7.6	8.9	10.4	12.44	13.8
Experience	9.6	8.4	7.3	7.8	5.7

4.5.5 *Earnings Function by Sector of Employment*

In the following section, we present results of fitting the Mincerian earnings function to three sectors of Botswana's economy; the public, private, and parastatal sectors. Table 4.40 presents results from an earnings function that is not corrected for choice of employment among the three sectors. The model performs equally well for the public and Parastatal, explaining 53% of the variation in earnings in those sectors. The explanatory power of the model is however relatively weak in the private sector. For the private sector, the model explains just about one-third of the variation in earnings.

Experience is more important in determining earnings for the private sector and least important in the public sector. The coefficient of the square of experience is not significant at 5% level of significance for both the public sector and Parastatals. Given the lack of information about workers in the public and parastatal sectors, one would expect experience to be an important variable in determining earnings. Yet the results here show otherwise. This could be a reflection of wages and salaries in the public and parastatal sectors being less tied to productivity. On the other hand, in the private sector, productivity is an important issue and thus experience shows up as important in determining earnings. In other words, it may be that unobserved individual influences, such as effort, are more important in the private sector. Fiszbein and Psacharopous (1993) show similar results for Venezuela.

The average private rate of return to education is highest for the public sector and lowest for the private sector. This is to be expected given that earnings are less compressed in the public sector than the private sector as shown in table 4.23.

Table 4.41 presents results based on an earnings function that is corrected for choice of employment. The choice variable is significant at 1% level for all the three sectors, but it is negative for the public and parastatals sectors, while it is positive for the private sector. The positive selectivity term for the private sector implies that those who choose to be in the private sector hold a comparative advantage at it. In other words, an individual with in private employment has higher expected earnings than a public employee with the same characteristics. The average rate of return (expected) between the private and the public sector are equalised while that of the parastatal sector is one percent lower than the other two. The explanatory power of the model improves quite substantially, especially for the parastatal sector, where the R square increases by 11 percentage points. These results suggest that not correcting for choice of employment, especially for the parastatal sector may bias the results quite significantly.

Table 4.40 *Basic Mincerian Earnings Function by sector of employment (SS)* $^{\Psi}$

Variable	Public sector	Private Sector	Parastatals
Constant	5.2 (48.)	5.05 (59.5)	5.46 (27.6)
Education	0.12 (16.6)**	0.10 (13.4)**	0.11 (8.1)**
Experience	0.046 (3.8)**	0.075 (6.9)**	0.06 (2.3)*
Experience Square	-0.0005 (-1.2)	-0.0013 (-3.2)**	-0.0008 (-0.9)
R square (Adjusted)	0.53	0.35	0.53
N	276	499	79

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 4.41. *Basic Mincerian Earnings Function by sector of employment- corrected for choice of employment (SS Data)* $^{\Psi}$

Variable	Public sector	Private Sector	Parastatals
Constant	6.4 (24)	4.9 (45.08)	7.8 (14.)
Education	0.09 (7.8)**	0.09 (7)**	0.08 (5.1)**
Experience	0.028 (2.5)*	0.07 (5.5)**	0.057 (2.5)*
Experience Square	-0.00023 (-0.6)	-0.0013 (-2.5)*	-0.00077 (-1.09)
Inverse Mills Ratio	-0.6(-4.9)**	0.47(2.8)**	-1.2(-4.1)**
R square (Adjusted)	0.57	0.36	0.64
N	276	499	79

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 4.42 and 4.43 are extensions of the function fitted in 4.40 and 4.41. We add family background, logarithm of hours worked, and training to the basic model. The result of adding these three variables is an improvement in the explanatory power of both the model corrected for choice of employment and one not corrected for it across the three sectors that employ labour. The R square for all three sectors increases by four percentage points. For the public sector, only education, experience and training are significant explanatory variables to earnings variation. Their coefficients are all significant at 1% level of significance. Logarithm of hours has a positive sign for the public sector, while it still has a negative coefficient for the other two sectors. Its coefficient is however, not significant for all the three sectors at 5% level of significance. For parastatals, it is only the coefficient of the level of education of the workers and their training that are significant at 1% and 5% levels of significance respectively. With the correction for choice of employment, however, experience also becomes a significant explanatory variable for earnings (its coefficient is significant at the 5% level). Variation in hours of work and education of father are not significant explanatory variables to this sector. For the private sector all coefficients, except that of hours of work, are significant at 1% level of significance.

Table 4.42 *Basic Mincerian Earnings Function by sector of employment and hours, training and family background (SS data)*[Ψ]

Variable	Public sector	Private Sector	Parastatals
Constant	4.8 (5.6)	5.7 (10.1)	8.4 (3.4)
Education	0.11 (14.04)**	0.08 (9.9)**	0.099 (6.1)**
Experience	0.046 (3.9)**	0.07 (6.7)**	0.046 (1.7)
Training	0.27 (4.7)**	0.28 (5.3)**	0.28 (2.1)*
Log Hours	0.072 (0.44)	-0.12 (-1.1)	-0.56 (-1.2)
Education of Father	0.007 (0.9)	0.019 (2.6)**	0.016 (0.89)
Experience Square	-0.00006 (-1.7)	-0.0013 (-3.2)**	-0.0004 (-0.5)
R square (Adjusted)	0.57	0.39	0.57
N	276	499	79

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 4.43 *Basic Mincerian Earnings Function by sector of employment and hours, training and family background- corrected for choice of employment (SS data)*[Ψ]

Variable	Public sector	Private Sector	Parastatals
Constant	5.5 (9.5)	5.5 (10.2)	10.5 (2.5)
Education	0.08 (7.2)**	0.07 (5.7)**	0.066 (3.9)**
Experience	0.03 (2.7)**	0.068 (5.6)**	0.044 (2.1)*
Training	0.23 (4.4)**	0.26 (5.1)**	0.26 (2.7)**
Log Hours	0.13 (1.4)	-0.1 (-1.1)	-0.5 (-1.2)
Education of Father	0.008 (1.1)	0.018 (2.3)*	0.011 (0.7)
Experience Square	-0.00039 (-1.0)	-0.0012 (-2.5)*	-0.00042 (-0.6)
Inverse Mills Ratio	-0.55(-4.4)**	0.32(2.1)*	-1.11(-4.3)**
R square (Adjusted)	0.60	0.40	0.67
N	276	499	79

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

4.6 AGE/ EXPERIENCE EARNINGS PROFILES

Earnings generally rise with age at a decreasing rate, and earnings profiles are higher the higher the individual's level of education (Polacheck &Siebert, 1993:19). In this section we present age-earnings profiles from both the HIES and supplementary survey data. The profiles are constructed by taking average earnings at each age for the different levels of education. The education levels here refer to completed levels as opposed to level attended. For instance, primary education refers to those who completed 7 years of education, but did not complete lower secondary (junior certificate).

Figure 4.1 Shows age-earnings profiles for four level of education and for those with no education at all. The highest earnings profile is that of workers with completed higher education, then those with upper secondary and those with lower secondary. Thus the results are as expected with the highest profile being for those with the highest level of education and the lowest being for those with no education. There is very little difference between the age earnings profiles of those with no school and those with primary education. The age earnings profiles for those with primary education and those with no education are relatively flat, implying that they have slower growth rates of earnings as their age increases. The earnings profiles for those with higher education and the two secondary levels rise, and reach a maximum at around the ages of 35 and 40 years of age.

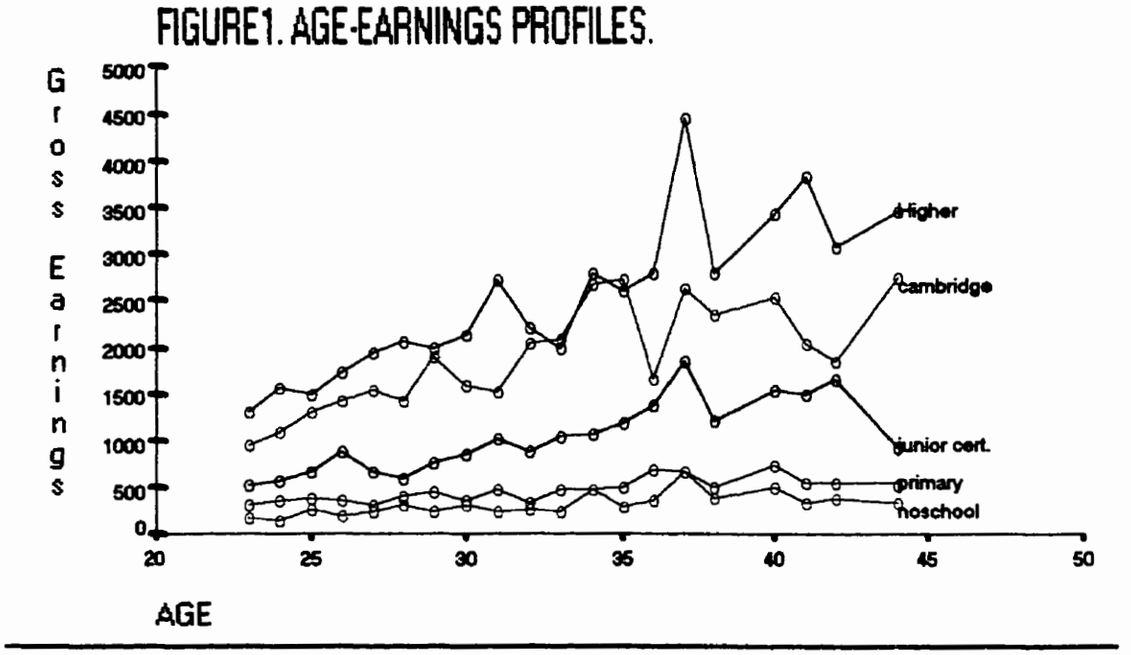
Figure 4.2 shows age earnings profiles that are smoothed out. The smoothing function used was parabolic: Earnings = f (Age, Age Squared). This gives us a clearer picture of the relationship between earnings profiles and also a better shape of the individual earnings profiles. Generally, the earnings-profiles between education levels

diverge as the age increase, at least up to the point of peak earnings of the profiles. The earnings profile for university education, senior secondary and no education are well behaved with a sort of concave shape; increasing at an increasing rate initially, then at a decreasing rate, reaching a peak and thereafter the earnings decline. The earnings profile of those with senior secondary and those with junior certificate converge after the age of 50.

If we assume that the earnings of the young with different education levels will have the same patterns in the future as those of the older wage groups today, we may conclude that the pattern of diverging age earnings profile implies that Botswana's labour market functions in such a way that the relationship between education and earnings becomes much more strongly established at later ages. Unfortunately the cross-section picture does not necessarily reflect lifetime earnings, especially that returns to education may have fallen for recent cohorts.

The age-earnings profiles by gender are shown as figure 4.3 and 4.4. Males have higher age earnings profiles for lower and upper secondary. The profiles for males also diverge from those of female workers as age increases (see figure 4.3). For primary education males have a higher profile up to about age 58. For tertiary, the profiles do no have a clear pattern. For less than 30 years of age, males have a higher profile. Between 32 and 47 females have a higher profile, thereafter the male worker's profile is again higher (see figure 4.4).

Figure 4.1 *AGE -EARNINGS PROFILES, ALL WORKERS (HIES Data)*[16]



[16] Cambridge is higher secondary education level, Junior Cert is lower secondary and higher education is equivalent to tertiary and university education levels.

Figure 4.2 *SMOOTHED- OUT AGE _ EARNINGS FUNCTIONS BY LEVEL OF EDUCATION, ALL THE WORKERS((HIES Data)*

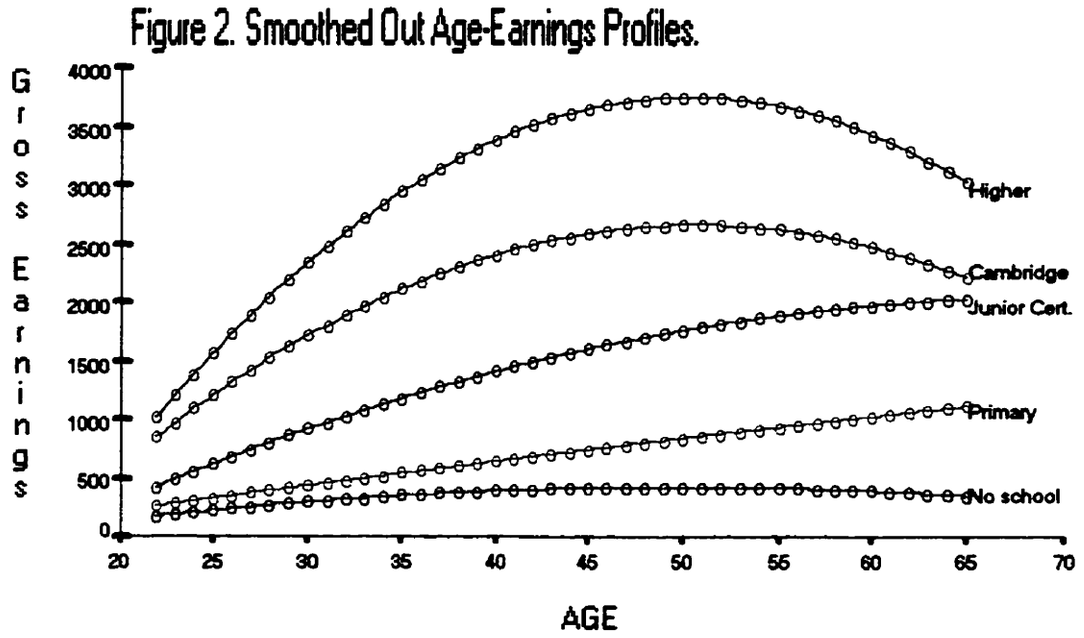


Figure 4.3 *Age - Earnings Profiles by gender - Upper and Lower Secondary*

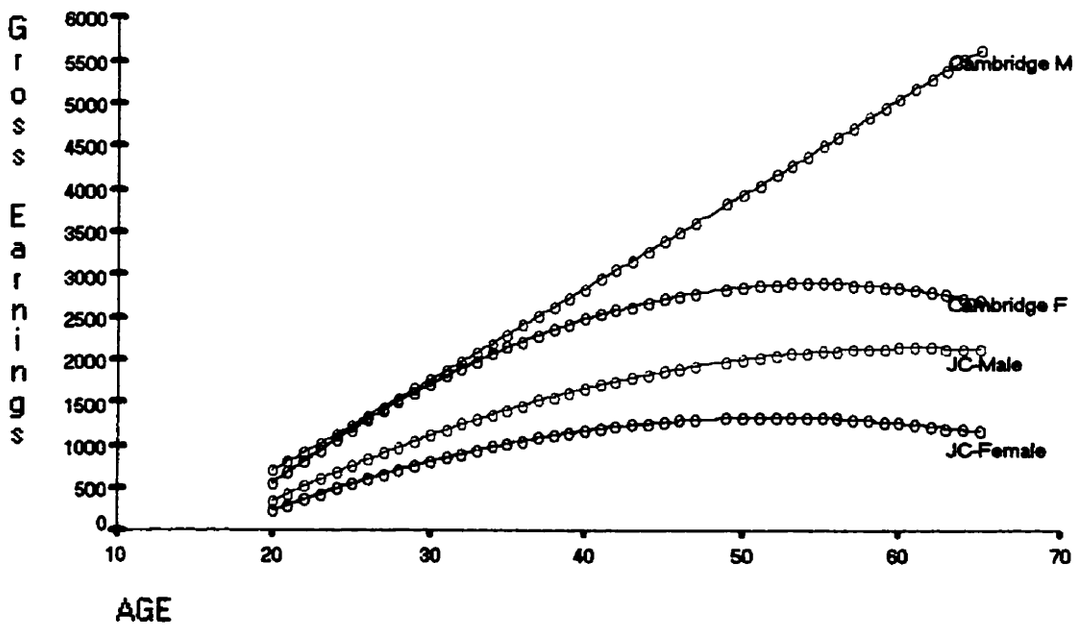
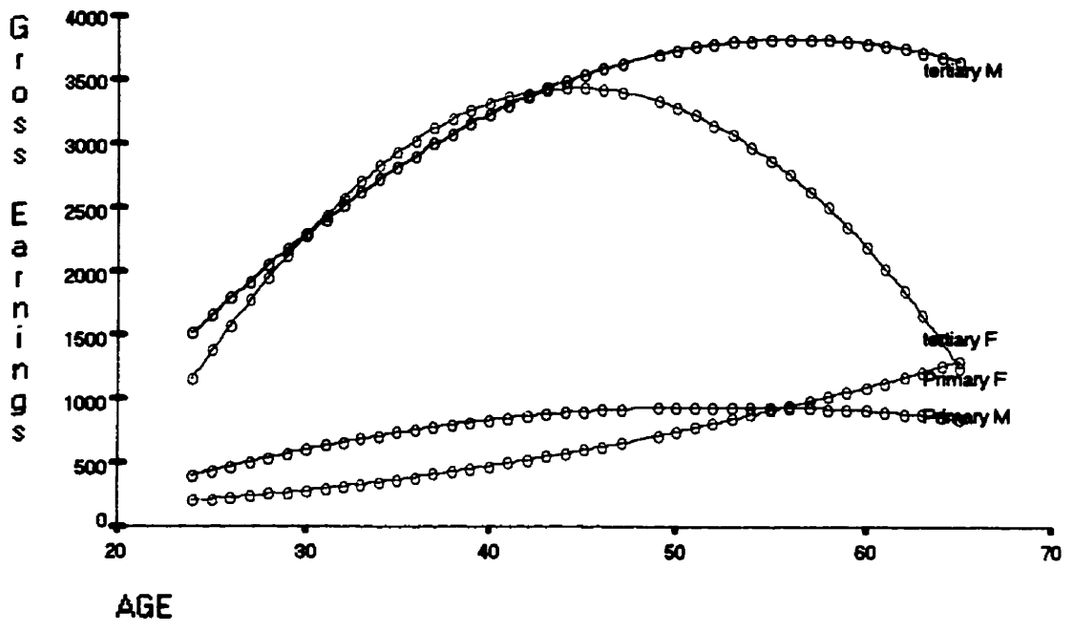


Figure 4.4 *Earnings Profiles by gender - Primary and Tertiary education levels*



Age earnings and experience earnings profiles from the supplementary survey are shown in figures, 4.5, 4.6, and 4.7. Age-earnings profiles from the supplementary survey generally have many similar characteristics to those obtained from HIES data. Figure 4.5 shows age earnings profiles for four level of education and for those with no education at all. The highest earnings profile is that of workers with completed higher education, then those with upper secondary and those with lower secondary. Thus the results are as expected with the highest profile being for those with the highest level of education and the lowest being for those with lower education. There is very little difference between the age earnings profiles of those with no school and those with primary education. Figure 4.6 is very similar to figure 4.5, except that we now substitute age for experience on the horizontal axis. The profiles are very similar to the age earnings ones, with the highest one being for those with higher education and the lowest for those with no

education. The experience earnings profile for those with completed primary education is however higher than for those with no education at all.

Even though the profiles oscillate a bit, it is clear that the earnings for university and the two levels of education do rise as the age and experience increase, even though the shapes of the profiles are not very clear. The age earnings profiles and experience earnings profiles for those with primary education and those with no education are relatively flat. This implies slower growth rates of earnings as age and experience increases for these groups of workers.

Figure 4.7 shows age earnings profiles that are smoothed out. Those with primary and those with no schooling have similar average earnings at ages between 20 and 35. After the age of 35 the earnings profiles for the two groups diverge continuously. Except for upper secondary (Cambridge) and junior certificate profiles that are almost parallel, all the profiles diverge as the age increases. The earnings profile for university education is well behaved with a sort of concave shape; increasing at an increasing rate initially, then at a decreasing rate, reaching a peak at around age 55 and thereafter the earnings decline as one nears retirement.

FIGURE 4.5 *AGE -EARNINGS PROFILES, ALL WORKERS (SS Data)*

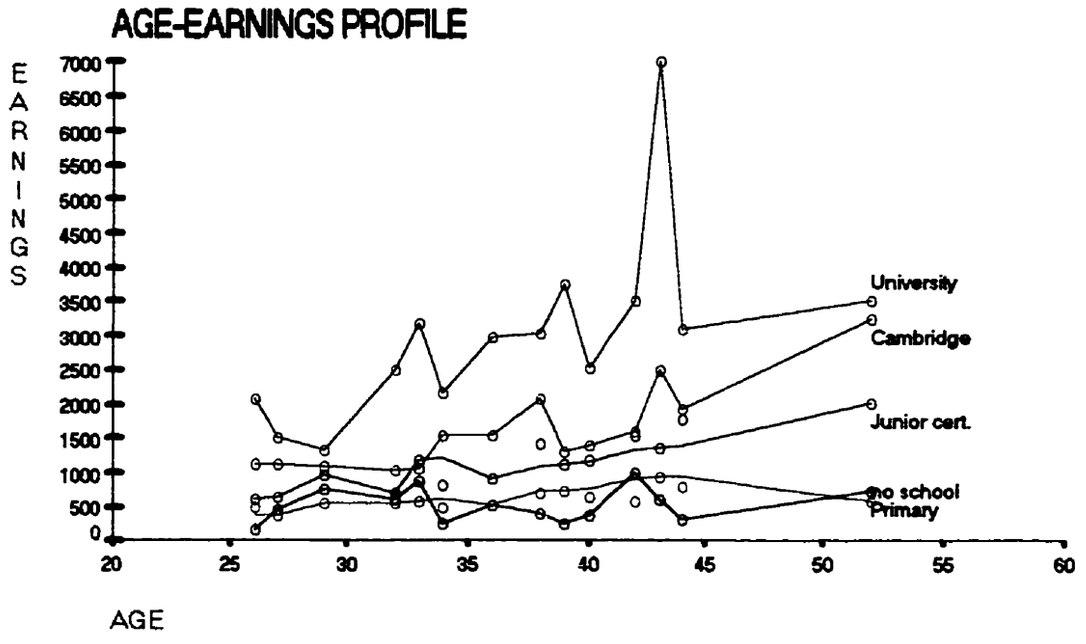


FIGURE 4.6 *EXPERIENCE - EARNINGS FUNCTIONS, ALL WORKERS*

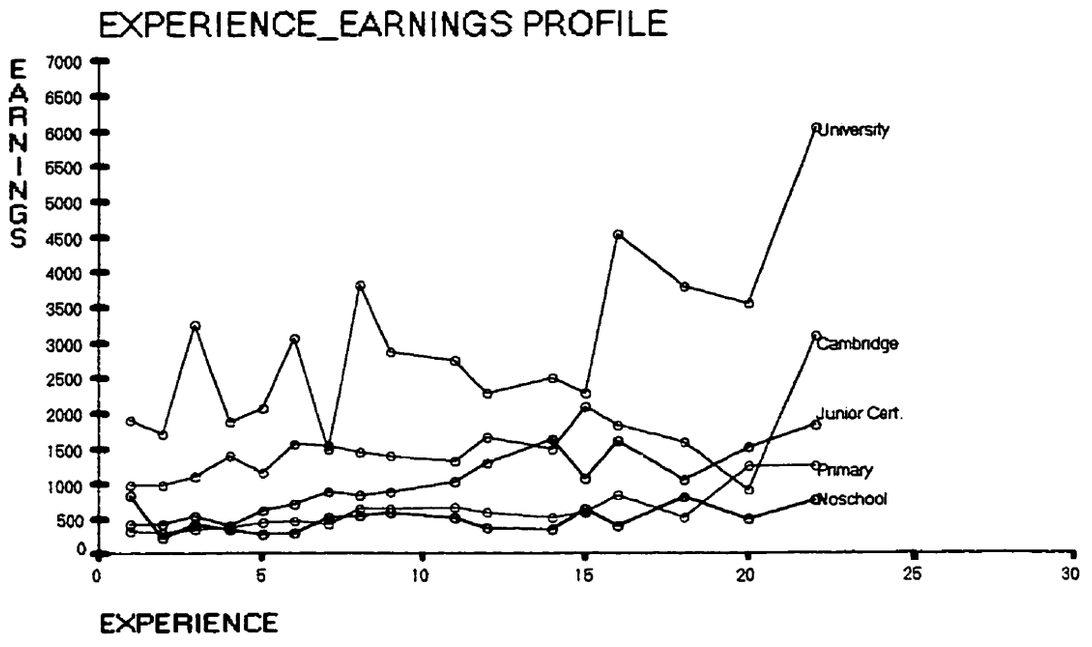
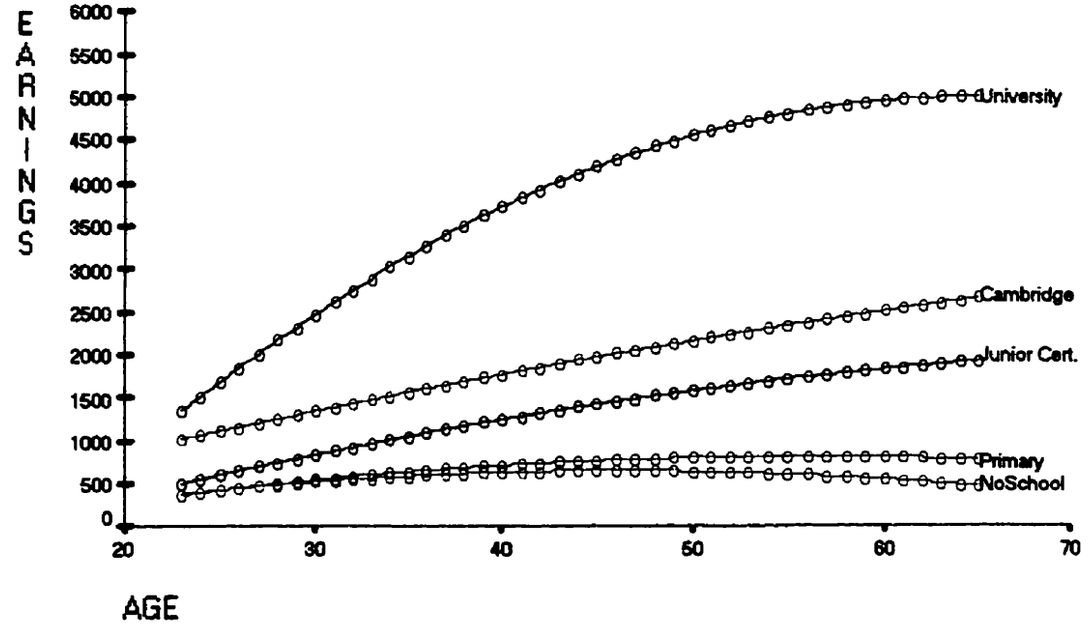


FIGURE 4.7 *SMOOTHED- OUT AGE _ EARNINGS FUNCTIONS BY LEVEL OF EDUCATION, ALL THE WORKERS (SS Data)*



4.7 The Relationship Between Education and the Labour Market Over Time

Labour markets, especially in less developed countries, are usually in continuous adjustment to disequilibria created by the demand for educated labour altering over the course of development process. On the demand side, the process begins with the emergence of a large public sector that provides the majority of formal sector employment. Later in development, a strong private sector emerges diminishing the importance of the public sector as an employer. The change in the economy usually leads to a change in the occupational structure, with demand for labour shifting from white collar jobs to blue collar jobs, especially in the manufacturing sector. Partly generating these changes and partly as a result, an expansion of the school system alters the composition of the labour supply, with each entering cohort of workers being more educated than the last. The result is a growing disparity between the structure of the labour force and the structure of employment opportunities leading to a "filtering-down" of educated workers into lesser skilled tasks (Cohen and House, 1994: 1556). Therefore, occupation and year of entry into the labour market may play a more central role in wage determination process in a developing country. To explore the extent of filtering down in Botswana's labour market we estimate a multinominal logistic model of occupational attainment[17].

We constructed these broad categories of occupational groups on the basis of skill requirements. The highest occupation on the rank is professional/managerial (OCC1);

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[17] A logistic regression model is a multivariate technique for estimating the probability that an event occurs as well as identifying the variables useful in making the prediction. This is useful in analysing data where the dependent variable takes on the value of 1 or 0. (See Norusis (1993) for more details).

e.g. doctors, economists, lecturers, etc. The next highest is the middle white collar (OCC2); e.g., primary school teachers, nurses, etc. The third highest on the list is junior white collar (OCC3); e.g. clerks, typists, etc. The next is a category of skilled blue-collar workers (OCC4); e.g. carpenters, electricians, bricklayers, etc. The fifth occupation at the bottom of the list is a group of semi-skilled blue-collar workers (OCC5); e.g. factory workers. At the bottom of the grouping are unskilled blue-collar workers (OCC6); e.g. cleaners, gardeners, messengers, domestic maids, etc.

To explore the determinants of occupation choice we included five variables measuring educational attainment (no schooling being the lowest and the highest being higher education), five variable measuring cohort effects, a dummy for sex (1=male, 0= female), and a dummy for location of worker (1= urban worker, 0= urban village). We expect that the more educated will favour the more skill-intensive jobs. Age is used as a proxy for date of entry into the labour force.

Table 4.44 presents maximum likelihood estimates of the variables included in the equation. Table 4.45 presents R Statistics for the variables by occupation. The chi-square, which is a test for the null hypothesis that the coefficient for all the terms in the current model, except the constant, are zero, is shown at the bottom of table 4.44. The model chi-square for all the five occupations is significant at 1% level of significance. These results imply that not all the coefficients in the model are zero in value. The fitness of the model is quite robust for all the five occupations. A further analysis of these coefficients is given by the R statistic presented in table 4.45. The R statistic lies between +1 and -1, with a small value indicating a small partial contribution of the variable and visa-versa.

The R statistic values are shown for all the occupations. For the occupation of professionals (OCC1), with the exception of primary and lower secondary (JC), all the variables have a zero R statistic. The R statistic for lower secondary and primary are negative, implying that possession of those two levels of education decreases the likelihood that a worker will be employed in the professional occupation, ceteris paribus.

For the occupation of middle white-collar (OCC2) being aged 25-34, no school and higher education have an R statistic value of zero. Being aged less than 25, having gone through primary or lower secondary and location, all have negative R statistics. The implication is that having been to lower secondary or primary levels of education or being aged less than 25 years reduces the likelihood that you may be employed in a middle white collar job as compared to being in the unskilled blue collar job (OCC6). Ages 45-54, age 55 plus and gender all have positive R statistics. What this means is that male workers and those aged above 45 years of age have more chances of occupying a job in the middle white class category of occupations relative to being in the unskilled blue collar job.

For junior white-collar occupation (OCC3), no school, ages 25-34 and 55 plus have R statistics values of zero. Being less than 25 years of age, or having been to junior secondary and primary education, sex and location all have negative R statistics values. What this means in terms of education and age is that being less than 25 years of age or having gone through primary or lower secondary reduces the likelihood of you being in a junior white collar job. Being male also reduces the probability of a worker being in this occupation, i.e. female workers are more likely to be in this occupation than male ones.

On the other hand the coefficient for age between 45-54 is positive. This implies that being in that age group increases the likelihood of a worker being in this occupation.

For the occupation of skilled blue collar (OCC4), only gender has a positive R statistics. This result implies that being male increases the likelihood of a worker being in this occupation. Location and ages 23-34 and 55 plus all have a zero R statistic. Ages less than 25 and 45-54, having gone through lower secondary or less all have a negative R statistic value. Falling within those two age ranges or having been to junior secondary education or less decreases the likelihood of a worker being in the occupation of skilled blue collar relative to being in an unskilled blue collar job.

Occupation 5 is that made up of semi-skilled blue-collar workers. In this occupation all the ages have a zero R statistic. Lower secondary or less years of education reduce the chances of being in this occupation vis-à-vis occupation 6 (unskilled blue-collar). In other words, with those characteristics a worker is more likely to find an unskilled blue-collar job than a semi-skilled blue-collar job. Gender has a positive R statistic for this occupation, implying that being male increases the probability of being in this occupation than being in occupation 6.

Table 4.44 has Wald Statistic in brackets. For all the occupations, except the semi-skilled blue collar, the coefficients for primary and lower secondary are significant at 5% level of significance. Age less than 25 is significant at the 5% level for middle white collar, junior white collar and skilled blue collar. Gender is only significant at the 5% level for the middle white-collar occupation.

Interpretation of logistic regression coefficients is not as straightforward as linear regression. This is because the coefficients show the logarithm of the probabilities of

being in one occupation relative to the other. In this analysis, locating in one occupation is being compared to locating in the occupation of unskilled blue-collar job. One way of interpreting the coefficients is to rank them by size across occupations. Ranking the coefficients on gender from smallest to highest gives the following results: occupation 3, occupation 5, occupation 2, occupation 1 and occupation 4. These results indicate that being male increases the likelihood that the worker is in skilled blue collar and professional jobs. On the other hand, being female increases the probability that you will be in any of the occupations lower on the list. The results clearly point to an occupational segregation of employment opportunities by gender where females are confined to a narrow range of occupations. Females are likely to be in any of the three categories of occupations; clerical / secretarial jobs (OCC3), semi-skilled blue-collar (OCC5) and middle white-collar jobs (OCC2).

A frequency tabulation of distribution of workers by gender with occupations confirms this results as shown in table 4.46. Male workers are a greater proportion in the following occupations; professional, skilled blue collar and semi-skilled blue-collar jobs. Females, on the other hand dominate in middle white collar, junior white collar and unskilled blue collar. Average earnings of all the occupations are also shown on the same table. It is clear that the occupations dominated by female workers (OCC2 &3) in the white collar section are on average less rewarding compared to those dominated by male workers (OCC1). For manual occupations, we also note that the female dominated occupation (OCC6) is less rewarding than the male dominated ones (OCC4 & OCC5). Occupational segregation is therefore an important explanation to the already observed paradox, where we observed that women are on average more educated than men, while

they earn less than their male counterparts. Koussodjie and Mueller (1983) find similar results. They argue that, due to sexual division of labour, many of the more attractive earnings possibilities that are open to men are closed to women.

It is not clear from our study whether the occupational segregation is itself a discrimination from a biased labour market or that the labour market is merely responding to workers having different observed characteristics that are heavily shaped at the family level. For instance, it might be that the family was encouraging girls to take such jobs as nursing, primary teaching, secretarial jobs, while encouraging boys to be in the professional jobs such as being managers, doctors, etc. Clearly, if the socialisation process at the family level is effective and carried over to schools the chosen occupation at the end will follow along that line, and the labour market will be responding by only taking the workers into their already chosen occupations. Republic of Botswana (1993) reports gender gap in academic performance in favour of boys at the primary and secondary levels. That differential is more pronounced for mathematics, science and technology. These results from the tendency for educational institutions to reflect the wider society by reproducing sex stereotypes and low expectations among girls. Many of these stereotypes are also perpetuated by textbooks and curriculum materials and are even reflected in the choice of subjects of boys and girls (Republic of Botswana, 1993: 35).

We provide similar ranking of coefficients by occupation for the four levels of education. As expected, no school, primary education and lower secondary education individually increase the likelihood that a worker would be in any of the low skill jobs; particularly, semi-skilled blue collar, skilled blue collar, unskilled blue collar and junior

white collar. With those levels of education, ceteris paribus, a worker has a low likelihood of getting into professional and middle white-collar jobs. On the other hand, higher formal education implies a higher probability that a worker is in a higher skill-based job; e.g. professional job or middle white collar.

The coefficients for different age groups are also ranked across occupations. Those aged less than 25 years of age are more likely to be into less skill-based jobs; e.g. factory worker (OCC5), clerk, typist (OCC3), carpenter, electrician (OCC4). Being aged 25 or less means you are less likely to be in the professional/ managerial jobs and middle white-collar jobs. Those aged between 25-34 are more likely to be in junior white-collar jobs (OCC3) and semi-skilled blue-collar (OCC5). On the other hand, those aged between 45- 54 are more likely to be in professional (OCC1) and middle white-collar (OCC2) jobs. In general, being older increases the likelihood of having an occupation higher up the skill ordering of occupations. This demonstrates that some filtering-down of jobs occurred when labour market conditions changed. Under today's labour market conditions, leaving school before completing secondary education is no longer sufficient to guarantee a white-collar job, whereas in the past most people with those qualifications automatically got those jobs. Filtering-down is likely to be more pronounced in a labour market that uses education to a larger extent as a screen for jobs.

Table 4.44 *Multinominal logit model of occupational attainment (excluded class: unskilled blue collar workers, OCC6)* $^{\Psi}$ *(SS data)*

	Managerial OCC1	Middle White OCC2	Junior White OCC3	Skilled Blue OCC4	semi-skilled blue OCC5
(High SEC) No school	-15.4(0.02)	-14.3(0.3)	-11.2(1.3)	-3.9(22.6)*	-2.36(8.3)*
Primary	-6.3(13.95)*	-6.9(71.2)*	-4.8(50.7)*	-3.02(17.7)*	-1.9(6.8)*
J. Cert.	-3.5(6.08)*	-3.4(24.96)*	-2.7(17.9)*	-2.06(8.1)*	-1.23(2.7)
Higher	20.89(0.03)	7.2(0.06)	_____	4.19(0.04)	_____
(Age 35-44) Age < 25	-10.2(0.02)	-2.2(10.7)*	-0.89(4.6)*	-0.76(4.1)*	-0.22(0.4)
Age 25-34	-9.6(0.03)	-0.08(0.03)	0.26(0.58)	-0.36(1.5)	-0.02(0.006)
Age 45-54	1.55(1.88)	1.04(2.04)	1.01(3.8)	-0.94(3.1)	0.12(0.08)
Age 55+	-8.1(0.0008)	2.3(5.1)*	-0.44(0.12)	-5.99(0.2)	-0.75(0.45)
SEX	1.35(1.75)	0.88(5.5)*	-0.46(2.7)	2.87(86.1)	0.94(17.9)*
Location	-1.56(1.6)	-1.03(5.7)*	-0.48(2.5)	0.33(0.01)	-0.12(0.17)
Constant	1.76	3.7	3.3	0.46	0.59
Chi-square	241.98	314.69	174.93	198.73	32.6

$^{\Psi}$ Figures in parenthesis are Wald Statistics

* Coefficient significantly different from zero at 5% level of significance

Table 4.45 *R statistic for all variables by occupation*[18]

	Managerial OCC1	Middle White OCC2	Junior White OCC3	Skilled Blue OCC4	semi-skilled blue OCC5
(High SEC) No school	0	0.57	0	-0.18	-0.1
Primary	-0.21	-0.37	-0.29	-0.16	-0.09
J. Cert.	-0.12	-0.21	-0.16	-0.099	-0.037
Higher	0	0	_____	0	_____
(Age 35-44) Age < 25	0	-0.13	-0.07	-0.058	0
Age 25-34	0	0	0	0	0
Age 45-54	0	0.088	0.056	-0.04	0
Age 55+	0	0.078	0	0	0
SEX	0	0.082	-0.03	0.37	0.017
Location	0	-0.017	-0.029	0	

[18] A statistic that is used to look at the partial correlation between the dependent variable and each of the independent variables. A positive value indicates that as the variable increases in value, so does the likelihood of the event occurring and visa-versa.

Table 4.46 *Proportion of workers in each occupation and average earnings in each occupation (SS data)*

	Managerial OCC1	Middle White OCC2	Junior White OCC3	Skilled Blue OCC4	semi-skilled blueOCC5	Unskilled OCC6
Male workers	74	44	25	9	59	38
Female works	26	56	75	91	41	62
Total	**100**	**100**	**100**	**100**	**100**	**100**
Average earnings(Pula)	3087.48	1511.09	855.91	855.16	613.87	423.51

CHAPTER FIVE

RATES OF RETURN TO EDUCATION IN AFRICA

5.1 *Introduction*

The main aim of this chapter is to summarise the literature on the rates of return to education in Africa, both social and private. We begin by introducing the concept of rate of return to schooling.

5.2 *The Concept of Rate of Return to Education*

Treatment of education as an investment allows economists to calculate the profitability of education by using the same cost-benefit principles used for appraising physical capital. A central concept in cost benefit analysis is the rate of return, which is a measure of profitability of an investment project. In general, it is a measure of the expected yield of an investment in terms of the future stream of benefits generated by the capital, compared with the cost of acquiring the capital asset (Woodhall, 1987b). The rate of return is precisely the rate of interest at which the present value of future benefits is exactly equal to the present discounted value of costs. This allows different investment projects to be compared with the optimum investment strategy to be chosen being the one that offers the highest rate of return.

When cost-benefit analysis is applied to investment in education one needs to identify both costs and benefits to education. Increased lifetime earnings are usually the benefits for schooling or training in the human capital models. These can then be compared with the direct costs of fees, expenditure on books and equipment, plus the indirect costs, which are forgone earnings while in school or training (Woodhall, 1987b). The rate of interest that equates these expected benefits to the expected costs is the

expected rate of return from that schooling.[19] To formalise this lets suppose an individual is evaluating whether to take an extra five years of school or look for a job after having a certain level of education. Let us assume the individual will be able to get an after tax annual income of $E_1(t)$ at each age from graduation up to retirement. Moreover the individual will have to pay some schooling costs C(t) in the form of tuition fees and purchases of books and materials. On the other hand, if the individual decides to work he is assumed to earn an annual income of Eo(t) until retirement. Lets denote R= retirement; and t= Age; E,...G= beginning of graduation for the level of education being evaluated; r is the rate of discount. The expected benefits are therefore

$$\sum_{t=G}^{R}[E_1(t)-E_0(t)](1+r)^{-t} \quad (1),$$

where E1(t)- Eo(t)= expected net differential attributable to the next higher level of education. The costs of this education are:

$$\sum_{t=E}^{G}[Eo(t)+C(t)](1+r)^{-t} \quad (2),$$

where the first part is forgone earnings and the second part is direct costs to education. Equating (1) and (2) then solves for the rate of return(r). In other words it is that rate of discount that equates future benefits to costs. Equating (1) and (2) and solving for r gives:

$$r = \frac{\sum_{t=G}^{R}[E_1(t)-E_0(t)]}{\sum_{t=0}^{S}[E_0(t)+C(t)]} \qquad (3).$$

[19] For a discussion on how students form expectations about future earnings see Katona (1980)

This is just one method available for calculating the rate of return, usually known as the elaborate method. Another method mostly used is the regression method based on Mincerian human capital earnings functions (Psacharopoulos, 1987). The individual making the decision is then assumed to use this rate of return to evaluate whether its worth going to school for another five years or not; in other words schooling is encouraged if the rate of return exceeds the rate of alternative investments. The rate of return calculated in the above manner is what will be called the private rate of return. But both the costs and benefits of education also affect society as a whole, since the assumed productivity of more educated workers also benefits society.

In most countries education is also paid for by government through subsidised education and free education for some levels of education. To take that into consideration a social rate of return is usually calculated by relating society's benefits to social costs of education (Psacharopoulos, 1987). The simplest correction is usually done by taking before tax earnings of individuals and subtracting subsidies from their costs. The difference between the two measures gives an indication of the degree of government involvement. A big difference between the two shows a high level of government subsidisation for the school level and income group (Jallade, 1982). Another major distinction is between average and marginal rates of return. The rate of return can be interpreted as the marginal if it refers to the whole cycle of a particular education level (for instance secondary versus primary education), but it would be interpreted as an average for six years of secondary schooling (Psacharopoulos, 1987).

5.3 Rates *of Return to Education in Africa*

The general pattern of rates of return to education, based mainly on Latin American countries is for the rates to be highest for primary followed by secondary and then lowest for higher education. For Africa as a whole Psacharopoulos' 1985 review estimates it to be 45% for primary, 32% for university and 26% for secondary and overall of 13%(Kugler and Psacharopoulos; 1989: 359). For the 1993 review it was however estimated to be 20, 13, and 12 for primary, secondary and higher education respectively (Psacharopoulos; 1994). However, Sub-Saharan country studies do not seem to support the pattern of rates of return reported in the aggregate rates of return. Table 5.1 summarises social and private rates of return figures for some sub-Saharan countries (7 out of 12 of those with complete sets of private rates are shown in the table).

Estimates from Lesotho and Malawi show a pattern of rising private rates of return as the education level rises. The private rates of return to those countries are highest for higher education, followed by secondary, and lowest for primary education. For Zimbabwe for both male and female workers the private rate of return to education based on data from a 1989 labour force survey of those in dependent employment only were highest for upper secondary, followed by lower secondary. Primary education was next, and university education was the least profitable (Bennel and Malaba; 1993: 277-287). For Cote d'Ivoire, the most profitable level to the individual was upper secondary and the least profitable lower secondary. On the other hand for Ethiopia it is lower secondary that is the most profitable level for the individual and upper secondary is the least profitable. From table 5.1, only Somalia and Botswana have primary education as the most profitable level of education. The Botswana estimates are based on a 1984

USAID study. For primary education, however the authors report that there were some fundamental reporting errors, and moreover Bennel rated the data quality as being among the very poor category (Bennel, 1996: 185).

The pattern of social rates of return is generally that the rates of return are either highest for upper secondary (Botswana, Zimbabwe) or lower secondary (Malawi, Ethiopia). The least profitable level from society's point of view is university education

Two important points are evident from table 5.1 Firstly, the pattern of rates of return reported by Pscharopoulos do not prevail for most of the Sub-Saharan countries. It is only in two of those countries shown in table 5.1 that the private rate of return to primary education is higher than either secondary or higher education. Bennel (1996) notes that the quality of data in the countries that have the highest rates of return being for the primary level of education is very poor. A second point is one made by Bennel (1996), that calculating rates of return to the whole secondary school cycle and not making a distinction between lower and upper secondary does mask a lot of important differences. Bennel (1996) argues that, if Pscharopoulos's aggregate rates of return are calculated with upper secondary and lower secondary being separated, the aggregate rate of return to upper secondary is, in fact, the highest and not primary education.

Table 5.1 *Private and social rates of return to education for some Sub- Saharan countries***

Country Study	Primary.	Lower Sec.	Upper Sec.	Secondary	University
Botswana (1984)	528 (42)	76 (41)	80 (62)	_____	38 (15)
Cote d'Ivoire (1987)	25.7	11.3	30.7	_____	25.1
Ethiopia (1972)	35 (20.3)	36.7 (28.6)	22.8 (18.7)		27.4 (9.7)
Lesotho (1983)*	15.5 (10.7)	_____	_____	26.7(18.6)	36.5 (10.2)
Malawi (1986)	15.7 (14.7)	26.3 (21.2)	16.8 (15.2)	_____	46.6 (11.5)
Somalia (1983)	59.9 (20.6)	13 (10.4)	25.1 (19.7)	_____	33.2 (19.9)
Zimbabwe (1992)	(M)15.5(11.3)	(M)25.6(22.8)	(M)59.1(61.5)	_____	(M)6.4(1.9)
	(F)17.7(11.1)	(F)32.5(26.6)	(F)37.9(33.7)	_____	(F)3.8(-4.3)

Source: Bennel (1996: 186-87)

**Social rates of return to education are reported in parenthesis

* The Lesotho study did only have rates of return to the whole secondary education cycle

CHAPTER SIX

PRIVATE AND SOCIAL RATES OF RETURN TO EDUCATION IN BOTSWANA - RESULTS FROM HIES AND A SUPPLEMENTARY SURVEY TO HIES

6.1 *Introduction*

This chapter presents private and social rates of return to education from two data sets; one from the HIES 1993/94 data and another from supplementary survey to HIES done in September to December 1996. The private rates of return to the different education cycles are calculated using both the earnings function method and the elaborate methods. These are calculated by gender, type of employment and by type of organisation. The social rates of return are estimated using only the elaborate method.

6.2 *Private Rates of Return to Education- Results from the Mincerian Earnings Function*

6.2.1 *Results From HIES Data*

Table 6.1 summarises the results of a Mincerian earnings function that has education as a non-continuous variable. We have here included 1-0 dummies for five schooling cycles as shown on the table. All coefficients are significant at 1% level of significance and have the correct signs. The explanatory power of the model improves quite substantially from an R square of 38% with the continuous education to 44% with education dummies for each education cycle. The R square for the model applied on male employees increases from 44% to 50%, while fitting it on female workers increases the R Square quite substantially from 47% to 58%. The increase in the R square relative to the continuous years of schooling specification can be interpreted as apparent (although by no means conclusive) evidence that in Botswana's labour market,

credentialism may be an important aspect in the explanation of the relationship between education and earnings.

Table 6.2 shows the results of fitting an earnings function that is corrected for sample selection bias. The results of making this correction are mainly the decrease in the values of the coefficients for all the education levels. The explanatory power of the model improves by about one percentage point. All the coefficients including the Inverse Mills Ratio term are significant at the 1 percent level.

Table 6.3 presents earnings premiums associated with each education cycle based on tables 6.1 and 6.2. The results from an earnings function not corrected for selection bias show earnings premiums to be rising by education level. Earnings premiums are generally highest for tertiary education and lowest for primary versus the illiterates. This is true for all the workers combined and by gender. When we correct for censoring bias, the highest premium becomes that of higher secondary and the lowest is still for primary (all workers and female workers).

Table 6.1 *Earnings function with schooling cycles dummies, all and by gender (HIES)*[Ψ]

Variable	All	Male	Female
Constant	4.2 (68.3)	4.5 (63.2)	3.9 (41.1)
Primary	0.43 (10.62)**	0.5 (11.8)**	0.5 (7.5)**
Lower Secondary	1.23 (26.8)**	1.05 (18.8)**	1.3 (16.7)**
Higher Secondary	2.1 (35.9)**	1.6 (18.8)**	2.05 (21.6)**
Tertiary	2.6 (32.6)**	1.97 (19.7)**	2.5 (19.08)**
Experience	0.095 (19.8)**	0.092 (16.2)**	0.0865 (12.4)**
Experience Square	-0.0015 (-14.8)**	-0.0014 (-12.7)**	-0.0015 (-9.8)**
R^2 (adjusted)	0.43	0.50	0.58
Sample Size (N)	2891	1587	1304

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 6.2 *Earnings function with schooling cycles dummies- corrected for censoring bias, all and by gender (HIES)*[Ψ]

Variable	All	Male	Female
Constant	5.07 (35.8)	5.3 (34.3)	4.4 (21.6)
Primary	0.4 (9.7)**	0.5 (10.8)**	0.48 (7.6)**
Lower Secondary	1.1 (23.3)**	0.96 (16.2)**	1.2 (16.04)**
High Secondary	1.9 (28.8)**	1.4 (17.3)**	1.9 (17.64)**
Tertiary	2.1 (21.9)**	1.5 (12.5)**	2.2 (13.4)**
Experience	0.057 (7.7)**	0.054 (6.8)**	0.066(5.9)**
Experience Square	-0.00095 (-7.4)**	-0.00093 (-6.7)**	-0.0012 (-6.2)**
Inverse Mills Ratio	-0.78(-6.6)**	-0.89(-5.9)**	-0.349-2.6)**
R^2 (adjusted)	0.44	0.51	0.58
Sample Size (N)	2891	1587	1304

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
• Significant at 5% level of significance

Table 6.3 *Approximate earnings premium associated with each successive level of education (%) (HIES)**

Education Level	Both Sexes	Males	Females
Primary (vs illiterate)	54 (49)	65 (65)	65 (62)
JC (vs primary)	186 (251)	125 (95)	205 (168)
COSC (vs JC)	477 (370)	205 (240)	410 (340)
Tertiary (vs COSC)	526 (150)	225 (50)	440 (230)

Source: Based on the earnings functions in tables 6.1 and 6.2

*The earnings premiums based on the model corrected for sample selection bias are in parenthesis

Table 6.4 and 6.5 are very similar to tables 6.1 and 6.2, except that now we distinguish those who completed the schooling cycle from those who did not complete the cycle. For the model without correction for selection bias (table 6.4), all coefficients with the exception of the coefficient for completed primary fitted on females only, are still significant at 1% level of significant and have the expected signs. Table 6.5 shows the results of fitting an earnings function with a correction for sample selection bias. The results of making the correction are very similar to the ones presented in tables 6.1 and 6.2. The major results are a decrease in the values of the coefficients of the various education levels and a slight improvement in the explanatory power of the model.

Table 6.6 shows the earnings premiums associated with each level of education. Earnings premiums generally increase with the level of education. Completed primary vis-à-vis incomplete primary has negative earnings premiums. This is probably due to a fact that those with less than complete primary education would be a dwindling group of much older workers who would have higher earnings from their many years of

experience on-the-job. Most people would have at least completed primary education in the last fifteen years. Incomplete senior secondary vis-à-vis completed junior secondary for females also have negative earnings premiums. The results of correcting for sample selection presents mixed results on the behaviour of earnings premiums. All the completed schooling levels have lower earnings premiums for the model that corrects for the bias than the one without correction while the opposite is true for the incompleted education cycles.

Table 6.4 *Earnings functions with completed schooling cycles dummies, all and by gender (HIES)*[Ψ]

Variable	All	Males	Females
Constant	4.3 (69.6)	4.44 (61.4)	3.8 (38.8)
Primary Incomplete	0.32 (7.1)**	0.49 (9.5)**	0.35 (4.6)**
Primary Complete	0.18 (4.0)**	0.13 (2.49)*	0.32 (5.2)**
JC incomplete	0.9 (15.4)**	0.93 (12.9)**	1.25 (14.2)**
JC complete	1.4 (28.8)**	1.44 (23.8)**	1.76 (23.4)**
COSC incomplete	1.5 (7.6)**	1.85 (7.3)**	1.5 (5.7)**
COSC Complete	2.1 (36.03)**	1.96 (28.6)**	2.6 (28.9)**
Tertiary	2.59 (32.8)**	2.38 (26.08)**	3.15 (26.2)**
Experience	0.083 (16.9)**	0.094 (16.14)**	0.089 (12.3)**
Experience Square	-0.0012 (-12.0)**	-0.0015 (-12.31)**	-0.0014 (-8.9)**
R square (adjusted)	0.45	0.49	0.56
Sample Size(N)	2891	1587	1304

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 6.5 *Earnings functions with completed schooling cycles dummies - corrected for sample selection bias, all and by gender (HIES)*[Ψ]

Variable	All	Males	Females
Constant	4.9 (33.5)	5.4 (32.6)	4.08(18.96
Primary Incomplete	0.33 (6.4)**	0.49 (8.8)**	0.36 (4.6)**
Primary Complete	0.14 (3.07)**	0.85 (1.6)	0.32 (4.6)**
JC incomplete	0.9 (16.4)**	0.95 (13.3)**	1.3 (15.9)**
JC complete	1.22 (19.4)**	1.18 (16.06)**	1.67 (18.4)**
COSC incomplete	1.5 (6.5)**	1.7 (8.8)**	1.5 (4.8)**
COSC Complete	1.9 (28.7)**	1.7 (21.5)**	2.5 (25.13)**
Tertiary	2.2 (21.08)**	1.8 (15.7)**	2.98 (18.4)**
Experience	0.056 (7.7)**	0.056 (7.01)**	0.077 (6.9)**
Experience Square	-0.000882 (-6.9)**	-0.00096 (-6.8)**	-0.0013 (-6.5)**
Inverse Mills Ratio	-0.6(-4.8)**	-0.97(-6.02)**	-0.24(-1.6)
R square (adjusted)	0.46	0.50	0.56
Sample Size(N)	2891	1587	1304

Ψ Note: t-statistics in parenthesis

**Significant at 1% level of significance

* Significant at 5% level of significance

Table 6.6 *Approximate earnings premium associated with each successive level of education, completed and incomplete cycles (%) (HIES)**

Education Level	Both Sexes	Males	Females
Primary incomplete (vs illiterate)	38 (39)	63 (63)	42 (43)
Primary complete (vs incomplete)	-18 (-24)	-49 (67)	-4 (-5)
JC incomplete (vs primary complete)	130 (135)	136 (30)	212 (232)
JC complete(vs incomplete JC)	156 (90)	170 (70)	330(160)
Incomplete COSC(vs JC complete)	42 (110)	220 (220)	-230 (-80)
Complete COSC(vsincomplete cosc)	372 (220)	*70 (0)*	900 (770)
Higher educ (vs complete COSC)	510 (230)	370 (50)	980 (750)

Source: Based on the earnings functions in table 6.3

*The earnings premiums based on the model corrected for sample selection bias are in parenthesis

In the following paragraphs we present results of the private rates of return for both workers and gender based on different Mincerian earnings functions that have already been discussed in the previous paragraphs[20]. Table 6.7 is a summary of the private rates of return to different schooling cycles, which is derived from tables 6.1 and 6.2. For all workers, the highest private return is for senior secondary (238.5%), followed by tertiary (131.5%). The lowest private rate of return is for primary education (7%). Female workers have higher private rates of return to education for all the education cycles except primary education. Primary education has equalised rates of return across

[20] The private rates of return are derived as per the discussion on methodology section of chapter three.

gender. The effect of adjusting for sample selection bias is to lower the private rates of return to upper secondary, primary and tertiary levels of education. The private rate of return to lower secondary however, increases with this correction. With the exception of males with higher secondary, the adjustment for selection bias has the effect of lowering the private rate of return to education. We have already noted that effect about the average rate of return in chapter three. In general, the private rate of return to education is highest for upper secondary education, followed by higher education, and is lowest for primary education.

Table 6.7: *Annual Private Rate of Return to Schooling for each Schooling Cycle with Dummies, All and by Gender (%)**

Education level	Both Sexes	Males	Females
Primary	7.7 (7)	9.3 (9.3)	9.3 (8.9)
Lower Secondary	62. (83.7)	41.7 (31.7)	68.3 (56)
Higher Secondary	238.5 (185)	102.5 (120)	205 (120)
Tertiary	131.5 (37.5)	56.25 (12.5)	110 (57.5)

Source: Based on tables 6.1 and 6.2
*The private rates of return figures based on the model corrected for sample selection bias are in parenthesis

Tables 6.8 and 6.9 present results of an earnings function with dummies for each year of education. Table 6.9 shows results of fitting an earnings function with correction for sample selection bias. For both the earnings function with and without the correction, the coefficients for the dummies for the first and second years of education are not

significant at 5% level of significance for all workers. For male workers, it is only the coefficient for the dummy for the first year of primary education that is not significant at 5% level of significance, while for female employees, the coefficients for the dummies for the first three years of education are not significant at the 5% level. For female workers the second year of primary education also has a negative coefficient. Beyond the third year of primary education the coefficient for the dummy for every year of education has the right sign and is significant at 1% level (without selection bias correction) and 1 and 5% level with correction for selection bias. The coefficients for experience and its square are also significant at 1% level of significance and have the correct signs. The general goodness of fit of the model is quite robust. The model explains about half or more of the variation in earnings.

Table 6.10 is a summary of the private rates of return to different levels of education, which are derived from tables 6.8 and 6.9. The results are very similar to the ones presented in table 6.7, which are derived from an earnings function with dummies for each education cycle instead of dummies for each year of education. For all the workers combined, the most profitable level of education is senior secondary, followed by tertiary level, and primary education is the least profitable. This is true even when we disaggregate by gender. Female workers have higher rates of return for all the education levels. The figures based on the model corrected for selection bias are lower than those without the correction for all the education cycles. With the selection bias correction the second profitable level of education is lower secondary while for female workers it is still tertiary education that is the next profitable level to higher secondary. Primary education

is the least profitable level from the individual point of view for both the model with and the model without correction for selection bias and across gender.

Table 6.8 Mincerian *earnings functions with yearly education dummies, overall and by gender*[Ψ]

Dependent variable: ln earnings (monthly earnings)

Variable	All	Males	Females
Constant	4.35 (72.33)	4.5 (62.5)	3.96 (41.95)
Standard one	0.24 (1.87)	0.28 (1.9)	0.37 (1.9)
Standard two	0.14 (1.5)	0.4 (3.9)**	-.22 (-1.4)
Standard three	0.36 (4.3)**	0.48 (5.4)**	0.17 (1.2)
Standard four	0.27 (3.5)**	0.52 (5.4)**	0.32 (2.96)**
Standard five	0.25 (2.96)**	0.37 (3.7)**	0.35 (2.9)**
Standard six	0.39 (5.6)**	0.53 (6.3)**	0.55 (5.6)**
Standard seven	0.44 (10.39)**	0.57 (11.5)**	0.62 (9.2)**
Form one	0.69 (6.06)**	0.66 (4.5)**	1.07 (6.9)**
Form two	0.79 (12.9)**	0.89 (11.65)**	1.09 (12.4)**
Form three	1.13 (21.7)**	1.2 (18.98)**	1.44 (18.7)**
Form four	1.16 (6)**	1.58 (6.4)**	1.1 (4.5)**
Form five	1.74 (27.6)**	1.7 (22.3)**	2.2 (23.3)**
First year university	1.97 (7)**	1.8 (5.9)**	2.5 (5.4)**
2nd year university	1.7 (9.8)**	1.9 (9)**	1.8 (6.8)**
Third year university	1.9 (13.4)**	1.8 (10.)**	2.5 (12.6)**
Fourth year university	2.17 (15)**	2.05 (12)**	2.75 (13.1)**
Fifth year university	2.3 (17.1)**	2.25 (13.4)**	2.8 (14.95)**
Sixth year university	2.8 (5.7)**	2.7 (5.9)**	_____
Experience	0.073 (14.9)**	0.086 (14.8)**	0.075 (10.7)**
Experience square	-0.0011 (-10.6)**	-0.0013 (-11.3)**	-0.0011 (-7.5)**
Training	0.52 (13.6)**	0.42(8.7)**	0.56(11.2)**
R square (adjusted)	0.49	0.52	0.61
Sample Size (N)	2891	1587	1304

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 6.9 Mincerian *earnings functions with yearly education dummies - corrected for selection bias, overall and by gender*[Ψ]

Dependent variable: ln earnings (monthly earnings)

Variable	All	Males	Females
Constant	6.3 (51.6)	5.8 (46.4)	4.9 (22.07)
Standard one	0.18 (1.2)	0.22 (1.4)	0.33 (1.06)
Standard two	0.072 (0.7)	0.33 (3.1)**	-.26 (-1.78)
Standard three	0.28 (3.1)**	0.4 (4.6)**	0.14 (0.9)
Standard four	0.16 (2.1)*	0.4 (4.6)**	0.26 (2.3)*
Standard five	0.11 (1.17)	0.27 (2.3)*	0.26 (2.1)*
Standard six	0.22 (3.1)**	0.4 (5.2)**	0.45 (3.9)**
Standard seven	0.25 (5.8)**	0.42 (8.4)**	0.5 (6.8)**
Form one	0.45 (4.5)**	0.49 (3.4)**	0.91 (7)**
Form two	0.46 (7.7)**	0.66 (8.9)**	0.89 (9.4)**
Form three	0.75 (13.8)**	0.96 (15.4)**	1.2 (12.5)**
Form four	0.55 (2.5)*	1.1 (5.2)**	0.8 (2.78)**
Form five	1.1 (16.5)**	1.3 (16.2)**	1.8 (14.8)**
First year university	1.3 (5.2)**	1.3 (4.8)**	2.1 (12.39)**
2nd year university	1.1 (8.2)**	1.39 (10.97)**	1.5 (5.6)**
Third year university	1.2 (12.8)**	1.4 (12.6.)**	2 (12.3)**
Fourth year university	1.3 (11.2**	1.48 (10.3)**	2.21 (12.4)**
Fifth year university	1.4 (13.7)**	1.6 (13.8)**	2.3 (13.99)**
Sixth year university	1.9 (11.3)**	2.0 (21.3)**	_____
Experience	0.012 (1.98)*	0.044 (6.7)**	0.038 (3.8)**
Experience square	-0.00051 (-4.9)**	-0.00094 (-7.8)**	-0.00079 (-4.7)**
Training	0.5 (13.5)**	0.4(8.4)**	0.55(10.2)**
Inverse Mills Ratio	-1.7(-17.1)**	-1.4(-11.8)**	-0.74(-5)**
R square (adjusted)	0.53	0.56	0.61
Sample Size (N)	2891	1587	1304

Ψ Note: t-statistics in parenthesis

**Significant at 1% level of significance

* Significant at 5% level of significance

Table 6.10 *Annual Private Rates of Return for Different Levels of Education, All and by Gender (%)**

Education level	All	Males	Females
Primary	7.9 (4)	11 (7.4)	12.3 (9.3)
Lower Secondary	51.7(27.3)	51 (36)	78 (53)
Higher Secondary	130 (45)	110 (55)	240 (135)
Tertiary	77.5 (17.5)	57.5 (17.5)	165 (77.5)

Based on table 6.9
*The private rates of return figures based on the model corrected for sample selection bias are in parenthesis

6.2.2 *Results from a Supplementary Survey Data*

In this section we present private rates of return to education from various forms of Mincerian earnings function for the supplementary survey data. Table 6.11 shows a Mincerian earnings function with dummies for various education cycles. All education levels, except primary education have coefficients that are significant at the 1% level. Fitting the Mincerian earnings function with dummies for each level of education improves the explanatory power of the model quite significantly. Table 6.12 shows earnings premiums associated with each successive level of education. For all workers and both males and females the earnings premium rises with the level of education. The highest premium is for tertiary education and lowest for primary education. Female workers have a higher premium for primary, junior secondary and tertiary education than

male workers. Male workers only have a higher premium than female workers for senior secondary.

Private rates of return to education derived from table 6.11 are shown in table 6.13. Private rates of return increase with the level of education. The most profitable level to the individual is tertiary level, followed by higher secondary and primary education is the least profitable level. Given the changes in the Botswana's labour market, it is not surprising that primary and lower secondary have lower profitability value than the other two upper levels. In particular there has been a considerable increase in supply of graduates from these two levels of education while there was a lower demand for this particular labour.

Table 6.11 *Earnings function with schooling cycles dummies, all and by gender*[Ψ]

Variable	All	Male	Female
Constant	5.4 (68.5)	5.7 (60.3)	4.9 (40.8)
Primary	0.11 (1.6)	0.14 (1.6)	0.23 (1.9)
Lower secondary	0.43 (5.7)**	0.43 (4.8)**	0.61 (5.1)**
Higher Secondary	0.92 (10.8)**	0.92 (9.1)**	1.02 (7.6)**
Tertiary	1.6 (16.7)**	1.5 (13.8)**	1.7(11.9)**
Experience	0.08 (11.5)**	0.056 (5.9)**	0.010 (9.9)**
Experience Square	-0.0017 (-6.5)**	-0.0009 (-2.8)**	-0.0025 (-6.7)**
Training	0.33 (8.7)**	0.28 (5.8)**	0.39 (7.3)**
R^2 (adjusted)	0.56	0.55	0.62
N	934	483	451

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance

Table 6.12. *Approximate earnings premium associated with each successive level of education, all and by gender (%).*

Education Level	Both Sexes	Males	Females
Primary (vs illiterate)	12	15	26
JC (vs primary)	42	38	58
COSC(vs JC)	*96*	97	93
Tertiary educ (vs COSC)	245	198	270

Source: Based on the earnings functions in table 6.11

Table 6.13 *Annual Private Rate of Return to Schooling for Each Schooling Cycle with Dummies, All and by Gender (%)*

Education level	Both Sexes	Males	Females
Primary	1.7	2.1	3.7
Junior Certificate	14	12.7	19.3
COSC	48	48.5	46.5
Tertiary education	61.25	49.5	67.5

Source: Based on table 6.11

Tables 6.14, 6.15, 6.16 and 6.17 show results of fitting a Mincerian earnings function with dummies for each education cycle by sector of employment. Table 6.15 shows results from correcting for choice of employment. For the private and public sectors, all coefficients with the exception of that for primary education dummy are significant at 1% level of significance. This is true for both the model corrected for choice of employment and one without the correction. For the parastatal sector, with the unadjusted model only experience, higher secondary and tertiary levels of education are significant explanatory variables to earnings variation. The explanatory power of the

model improves quite significantly for all the three sectors compared to the model with continuous years of education. The adjusted R square for all sectors increase by about 9 percentage points. The choice correction variable (Inverse Mills Ratio) is a significant explanatory variable for the public sector (at 5% level) and the parastatal sector (at 1% level) and not in the private sector. For all the three sectors, earnings premiums increase with the level of education. The highest premium is obtained for tertiary education, followed by higher secondary, and primary has the lowest earnings premium.

For all the three sectors, primary education has the lowest private rate of return to education, and it is even negative for the parastatal sector. The highest private rate of return to education for the private sector is for senior secondary, while it is higher education that has the highest return for the public and parastatal sectors. Adjusting for choice of employment generally results in lowering of rates of return to most education levels but generally leaves the pattern of rates of return unchanged. The effect of adjusting for choice of employment in the private sector is to make the rates of return to senior secondary and higher education higher than before the adjustment, while in the public and parastatal sectors, it is the rate of return to primary education that is larger than before the adjustment. The adjustment lowers the rates of return to education for all the other education levels, with the exception of primary schooling.

The results also show that the highest rate of return to lower secondary is obtained from employment in the parastatal sectors of the economy, followed by public sector employment. For tertiary education level, the most profitable sector from the individual point of view is the public sector, then the parastatal sector. For senior secondary, the most profitable sector is the private sector. Adjusting for choice of

employment, however, makes working in the private sector the most profitable for all the levels of education, except primary education. These results obviously come from the fact shown in table 3.23 that the differences in earnings between those with tertiary, lower secondary education levels and the respective preceding education levels are larger in the public and parastatal sectors than in the private sector. On the other hand, the differences in earnings between those with upper secondary and those with lower secondary are larger in the private sector than in the public and parastatal sectors. The tertiary education behaviour is easily explained by the fact that government salaries are less compressed at that level resulting mainly from the 1992 government decompression exercise.

Table 6.14 *Earnings function with schooling cycles dummies, by sector of employment*[Ψ]

Variable	Private Sector	Public Sector	Parastatal Sector
Constant	5.9 (11.1)	5.5 (6.7)	8.3 (3.5)
Primary	0.09 (0.9)	0.09 (0.77)	-0.21 (-0.87)
Lower Secondary	0.32 (2.9)**	0.46 (3.6)**	0.35 (1.6)
High Secondary	0.96 (7.8)**	0.74 (5.4)**	0.79 (3.4)**
Tertiary	1.43 (9.6)**	1.5 (10.3)**	1.36 (5.1)**
Experience	0.077 (7.6)**	0.049 (4.6)**	0.088 (3.4)**
Experience Square	-0.0016 (-4.3)**	-0.0007 (-2.1)*	-0.0015 (-1.8)
Training	0.23 (4.5)**	0.31 (5.5)**	0.22 (1.8)
R^2 (Adjusted)	0.46	0.62	0.64
N	499	276	79

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 6.15 *Earnings function with schooling cycles dummies (adjusted for choice of employment) by sector of employment*[Ψ]

Variable	Private Sector	Public Sector	Parastatal Sector
Constant	6.2 (11.75)	5.9 (10.9)	10.5 (3.8)
Primary	0.058 (0.4)	0.11 (0.98)	0.12 (0.6)
Lower Secondary	0.33 (2.3)**	0.36 (2.9)**	0.32 (2.3)*
High Secondary	0.99 (6.3)**	0.57 (4.1)**	0.65 (4)**
Tertiary	1.5 (6.5)**	1.2 (7.9)**	1.09 (4.6)**
Experience	0.08 (6.7)**	0.038 (3.4)**	0.067 (3.1)**
Experience Square	-0.0016 (-3.5)**	-0.0006 (-1.6)	-0.0011 (-1.8)
Training	0.23 (4.58**	0.3 (5.9)**	0.26 (2.5)*
Inverse Mills ratio)	-0.21(-1.2)	-0.34(-2.2)*	-0.98(-2.7)**
R^2 (Adjusted)	0.46	0.62	0.69
N	499	276	79

Ψ Note: t-statistics in parenthesis

**Significant at 1% level of significance

* Significant at 5% level of significance

Table 6.16 *Approximate earnings premium associated with each successive level of education by sector of employment (%)*

Education Level	Private	Public	Parastatals
Primary (vs illiterate)	9.4 (5.9)	9.4 (12)	-19 (12.7)
JC (vs primary)	29 (33.1)	49 (31.4)	61 (25)
COSC(vs JC)	122 (130)	52 (34)	78 (53.9)
Tertiary educ (vs COSC)	160 (179)	240 (153)	170 (105.4)

Source: Based on the earnings functions in tables 6.14 and 6.15

*The earnings premium figures based on the model corrected for choice of employment are in parenthesis

Table 6.17 *Annual Private Rate of Return to Schooling for Each Schooling Cycles with Dummies, by Sector of Employment (%)*

Education level	Private Sector	Public Sector	Parastatal Sector
Primary	1.3 (0.8)	1.3 (1.7)	-2.7 (1.8)
Junior Certificate	9.7 (11)	16.3 (10.5)	20.3 (8.3)
COSC	61 (65)	26 (17)	39 (26.95)
Tertiary education	40 (44.75)	60 (38.25)	42.5 (26.35)

Source: Based on tables 6.14 and 6.15
*The private rates of return figures based on the model corrected for choice of employment are in parenthesis

Table 6.18 shows results of fitting an earnings function with dummies for each year of education for all workers and by gender. The coefficients for the first six years of schooling and the first year in senior secondary are not significant at 5% level of significance for all workers and by gender. Private rates of return to education for all workers and by gender are shown in table 6.19. For all the workers combined the private rates of return to education rise by level of education, being highest for higher education and lowest for primary education.

Tables 6.20 and 6.21 show the rates of return to education by age cohort and for each education level. Average rates of return to education rise as age increases and reach a peak at ages 35-44 and begin to fall (see table 6.20 for these results). For primary, lower secondary and tertiary levels of education, rates of return to education generally rise with increase in age. For example for primary and lower secondary levels, the highest rates of return are obtained by the 55 plus age cohort. This might reflect the diminishing

scarcity value of these education levels as age decreases. For higher secondary, however, the rate of return falls as age increases (see table 6.21).

Table 6.18 Mincerian *earnings functions with yearly education dummies, overall and by gender*[Ψ]

Dependent variable: Ln earnings (monthly earnings)			
Variable	All	Males	Females
Constant	5.4 (70.84)	5.8 (60.77)	5.05 (43.5)
Standard one	-0.26 (-0.9)	-0.19 (-0.4)	-0.10 (-0.3)
Standard two	0.21 (1.3)	0.15 (0.8)	0.31 (1.3)
Standard three	0.049 (0.29)	0.04 (0.3)	0.08 (0.4)
Standard four	0.17 (1.5)	0.31 (2.2)*	0.12 (0.78)
Standard five	0.65 (0.58)	-0.02 (-0.14)	0.29 (1.5)
Standard six	-0.004 (-0.04)	-0.05 (-0.3)	0.26 (1.9)
Standard seven	0.15 (1.97)*	0.17 (2.0)*	0.25 (2.2)*
Form one	0.32 (2.7)**	0.35 (2.4)*	0.4 (2.3)*
Form two	0.93 (14.97)**	0.29 (3.05)**	0.48 (4.09)**
Form three	0.59 (7.5)**	0.6 (6.0)**	0.81 (6.6)**
Form four	0.13 (0.8)	0.39 (1.4)	0.3 (1.5)
Form five	1.0 (11.99)**	0.95 (9.4)**	1.17 (9.06)**
First year university	1.25 (4.3)**	1.17 (3.5)**	1.24 (2.7)**
2nd year university	1.24 (7.3)**	1.1 (3.2)**	1.54 (8.0)**
Third year university	1.48 (11.27)**	1.5 (8.3)**	1.67 (9.5)**
Fourth year university	1.73 (15.01)**	1.62(3.4)**	1.97 (9.9)**
Fifth year university	2.33 (8.07)**	1.61 (3.4)**	2.88 (8.7)**
Sixth year university	1.6 (7.6)**	1.5 (7.2)**	_____
Experience	0.073 (9.9)**	0.046 (4.8)**	0.085 (8.6)**
Experience square	-0.0014 (-5.3)**	-0.0006 (-1.9)	-0.0021 (-5.5)**
Training	0.31(8.3)**	0.26(5.5)**	0.35 (6.8)**
R square (Adjusted)	0.60	0.58	0.67
N	934	483	451

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 6.19 *Annual Private Rates of Return for Different Levels of Education, All and by Gender (%)*

Education level	All	Males	Females
Primary education.	2.3	2.7	4
Junior Secondary	21.3	21	32.3
Senior Secondary	45	26	47.5
Tertiary	72.5	61.25	99.25

Based on table 6.18

Table 6.20 *Annual Average Rates of Return to Different Age Cohorts*

AGE	Average Rate of Return (%)
<25	11.9
25-34	12.4
35-44	13
45-54	12.3
55 +	10.8

Table 6.21 *Annual Private Rates of Return to all education levels by age cohort*

Age	Primary	Lower Sec.	High Sec.	Tertiary
<25	-0.085	4.28	41.65	16.31
25-34	1.0	14.2	28.4	12.6
35-44	1.3	22.75	13.08	18.5
45-54	3.4	21.8	11.9	27.2
55 +	4.9	27.4	____	___

Tables 6.22 and 6.23 show the results of fitting a Mincerian earnings function with dummies for each year of education by sector. Table 6.23 has a variable for correcting for choice of employment. The inverse Mills Ratio is however, statistically significant from zero for an earnings function fitted on the public sector. For all the three sectors, the coefficients for the whole primary school cycle (except for standard five and six for parastatal and public sectors respectively) are not significant at 5% level of significance. Almost all the coefficients for the years in university are significant at 1% level of significance. The coefficient for form five is also significant at 1% level of significance for all the three sectors.

Table 6.24 summarises the private rates of return by sector, which are based on tables 6.22 and 6.23. For all the private and public sectors, the private rate of return rises with the level of education, being highest for higher education and lowest for primary education. Senior secondary has the second highest private rate of return to education. For the parastatal sector the highest private rate of return is for senior secondary, followed by higher education. Primary education has the lowest and in fact negative private rate of return for this sector. Correcting for choice of employment only lowers the values of the private rates of return but does not change their pattern. Except for tertiary education (which is more profitable in the private sector) these results are very similar to the ones obtained from using a model with dummies for each education cycle instead of each year of education (refer to table 6.17 for a comparison of these results).

Table 6.22 Mincerian *earnings functions with yearly education dummies, by sector of employment*[Ψ]

Dependent variable: Ln earnings (monthly earnings)

Variable	Private Sector	Public Sector	Parastatal Sector
Constant	5.5 (50.91)	5.9 (44.9)	5.9 (28.5)
Standard one	0.38 (0.7)	_____	_____
Standard two	0.077 (0.4)	_____	-0.08 (-0.22)
Standard three	0.065 (0.4)	-0.17 (-0.6)	_____
Standard four	0.21 (1.4)	-0.12 (-0.6)	-0.16 (-0.5)
Standard five	-0.03 (-0.2)	0.06 (0.25)	-0.95 (-1.9)*
Standard six	-0.012 (-0.09)	-0.44 (-2.2)*	-0.23 (-0.6)
Standard seven	0.10 (0.97)	-0.03 (-0.2)	-0.2 (-0.8)
Form one	0.25 (1.)	-0.04 (-0.14)	0.43 (1.4)
Form two	0.24 (2.2)*	0.35 (2.6)**	0.27 (1.12
Form three	0.59 (5)**	0.45 (3.6)**	0.47 (2.2)*
Form four	0.53 (2)*	0.10 (0.4)	-0.3 (-0.6)
Form five	1.1 (9.3)**	0.76 (5.9)**	0.9 (4.6)**
First year university	_____	_____	_____
2nd year university	1.2 (4.7)**	1.3 (5.3)**	0.72 (2)*
Third year university	1.4 (6.1)**	1.4 (8.1)**	1.5 (4.2)**
Fourth year university	1.8 (9)**	1.45(9.0)**	1.4 (4.7)**
Fifth year university	2.6 (7.3)**	1.43 (3.2)**	_____
Sixth year university	-0.68 (-1.4)	1.7 (6.2)**	2.3 (6.6)**
Experience	0.079 (7.6)**	0.045 (3.8)**	0.075 (2.9)**
Experience square	-0.0016 (-4.2)**	-0.00045 (-1.1)	-0.001 (-1.2)
R square (adjusted)	0.50	0.59	0.73
N	499	276	79

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 6.23 Mincerian *earnings functions with yearly education dummies (corrected for choice of employment) by sector of employment*[Ψ]

Dependent variable: Ln earnings (monthly earnings)

Variable	Private Sector	Public Sector	Parastatal Sector
Constant	5.5 (32.1)	6.4(25.8)	4.6 (8.4)
Standard one	0.36 (1.3)	_____	_____
Standard two	0.077 (0.4)	_____	-0.02 (-0.07)
Standard three	0.063 (0.3)	-0.11 (-0.5)	_____
Standard four	0.2 (1.2)	-0.17 (-0.5)	-0.07 (-0.4)
Standard five	-0.05 (-0.3)	0.07 (0.4)	-0.87 (-3.9)*
Standard six	-0.02 (-0.13)	-0.47 (-2.5)*	-0.12 (-0.5)
Standard seven	0.088 (0.58)	-0.08 (-0.5)	-0.57 (-0.2)
Form one	0.24 (1.3)	-0.11 (-0.5)	0.6 (1.4)
Form two	0.22 (1.4)	0.27 (1.6)	0.5 (1.5
Form three	0.56 (3.3)**	0.33 (2.1)*	0.68 (2.1)*
Form four	0.51 (1.7)	-0.019 (-0.7)	-0.1 (-0.4)
Form five	1.07 (6.5)**	0.6 (3.6)**	1.2 (3.1)**
2nd year university	1.2 (6.2)**	1.05 (5.7)**	1.01 (1.4)
Third year university	1.3 (6.1)**	1.2 (6.4)**	1.8 (3.4)**
Fourth year university	1.7 (8.3)**	1.21(6.2)**	1.7 (3.3)**
Fifth year university	2.5 (13.7)**	1.09 (5.5)**	_____
Sixth year university	-0.7 (-4.3)	1.4 (6.1)**	2.8 (4.2)**
Experience	0.077 (6.03**	0.037 (3.1)**	0.08 (3.4)**
Experience square	-0.0016 (-3.02)**	-0.00037 (-0.9)	-0.0011 (-1.3)
Inverse Mills Ratio	0.12(0.6)	-0.3(-3.0)**	0.63 (0.7)
R square (adjusted)	0.50	0.0.60	0.74
N	499	276	79

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 6.24 *Annual Private Rates of Return for Different Levels of Education, by Sector (%)*

Education level	Private	Public	Parastatals
Primary education.	1.4 (1.3)	-0.4 (-1.1)	-2.6 (-6.1)
Junior Secondary	23.3 (22)	20 (15.7)	26 (46.7)
Senior Secondary	60 (57.5)	28.5 (21.5)	43 (66.5)
Tertiary	75 (65)	54 (39.5)	40 (55)

Based on tables 6.22 and 6.23
*The private rates of return figures based on the model corrected for choice of employment are in parenthesis

6.3 *Private and Social Rates of Return to Education - The Elaborate Method*

We have already noted that the rate of return estimated using a Mincerian earnings function only takes into consideration the forgone earnings as the only type of cost for going through the particular education cycle. To account for the private direct costs of education and subsidies from government, we use the elaborate method. This amounts to using the standard formula for internal rates of return. This also allows us to estimate the social rates of return for different levels of education. To calculate the private rate of return to a particular schooling level, we divide the differences in net earnings of those who completed the particular level and the preceding one by the costs of education. The costs are both direct private cost and opportunity costs of that level. For primary education, the benefits are the earnings of those with primary education less earnings for those with no schooling at all. To calculate the social rate we add the cost

per student from society, which is in the form of subsidy or grant. The earnings are also gross instead of net.

The direct costs to education for three levels, primary education, lower secondary and upper secondary were obtained from the supplementary survey to HIES. The mean direct costs for primary, lower secondary and upper secondary from the survey data were P300.12, P412.51, and P761.23 respectively. These costs are quite comparable to those obtained by Atta, et al. (1996) (see table 6.25). These were P383, P548.72, and P872.41 for primary, lower secondary and upper secondary respectively (Atta, et al. 1996: 84&95). The results from the study by Atta and others (1996) are however more detailed than ours since they had a detailed breakdown into various items that make up the total direct costs. The unit costs of education for the various education levels are shown in table 6.26. These are based on estimates from the ministry's planning estimates for 1996/97. These are obtained by dividing the recurrent expenditure by the total enrolment for that level. The table shows that the real cost of university education has been going down since 1984/85. It also went down for secondary education between 1989/90 and 1996/97. The real cost of primary education however, went up between 1984/85 and 1996/97. The ratio of the unit costs show that in 1989/90 the cost for educating one university student was 45 times that of a primary school child, 10 times that of a junior secondary school child and 8 times that of a senior secondary school child. For 1996/97 the cost for educating one university student was slightly lower at 21 times that of a primary school child and 9 times that of a junior secondary school child. The ratio of the unit costs of educating a university student to a senior secondary school student is still the same as in 1989/90 at 1:8.

Table 6.25 *Private direct costs of education (Pula amount)**

Education Level	Direct Private Costs- Survey results	Direct Private Costs- Atta, et. al.
Primary	300.12	383
Low Secondary	412.51	548.72
High Secondary	761.23	872.41

*Source: estimates from survey and report by Atta, et.al. (1996)

Table 6.26 *Unit Costs of Education- constant 1995/96 Prices (Pula)*

Education Level	1984/85	1989/90	1996/97
Primary	501	552	826
Low Secondary	____	2537	1860
High Secondary	____	3282	2200
University of Bots.	25352	24955	17374

** 1989/90 estimates at constant 1995/96 prices obtained from planning estimates for 1996/97, pg. 13

6.3.1 *Private and Social Rates of Return to Education - HIES Data*

Table 6.27 shows private and social rates of return calculated using the elaborate method. The private rates of return to education from the elaborate method are very similar to those reported in tables 6.7 and 6.10. The returns are however lower than those obtained from the Mincerian earnings. This is because the elaborate method accounts for private direct costs, while the Mincerian earnings function results only use forgone earnings as the only costs. The returns are highest for upper secondary education (23.8%), followed by lower secondary (11.9%), and tertiary education (11.8%). Primary education has the lowest rate of 4.6%. Social rates of return are highest for upper secondary, followed by junior secondary education. Primary education and higher education have the lowest social rate of 3.7% each. For both the individual and society, primary education has the lowest profitability, while upper secondary is the most profitable level.

An index of the subsidisation of education was also calculated by taking the percentage by which the private rate exceeds the social rate. The index rises by level of education, being highest for tertiary education and lowest for primary education. The results imply that the most subsidised level of education is higher education and the least is primary education. Therefore the highest distortion between private and social rates happens at tertiary education level and the least is at primary education level.

The figures in parenthesis on the column for higher education are private rates and index of subsidisation calculations based on an assumption that there is some cost recovery in the form of students paying back 5% of their starting salaries for a period equivalent to the length of study of their programmes. We assume a starting salary of

P2000.00 per month for someone graduating from a 4 year university programme. This gives a private direct figure of P4800.00 for the whole programme. This amount is also subtracted from the subsidy, since its assumed to be a part paid out by the student. The result of this adjustments were to lower the private rate of return to 6.7%. This however does not change the general results; upper secondary is still the most profitable level for both the individual and society, and junior secondary education is next. The highest distortion is still at the tertiary education level, but it is by a lesser percentage as expected.

Table 6.27 *Annual Private and Social Rates of Return, All workers- Elaborate Method (%)*

Education Level	Primary	Low secondary	High Secondary	Tertiary
Private Rate	4.6	11.9	23.8	11.8(6.7)
Social Rate	3.7	7.8	15.2	3.7
Index of public subsidisation*	24.3	52.6	56.6	2.8.9(81)

* The index of subsidisation measures the percentage by which the private rate exceeds the social rate

Table 6.28 below shows the private and social rates of return by gender. Female workers have higher private and social rates for all levels except primary education compared to their male counterparts. Part of the explanation to this apparent paradoxical result is the lower forgone earnings of female workers. For male workers, private rates are highest for upper secondary, then junior secondary and lowest for primary education. The results are not affected by an assumption of cost recovery for tertiary education. Social rates are highest for upper secondary, followed by junior secondary and lowest for

higher education. The social rate of return has the same pattern for female workers. The private rates by education level for female workers are highest for upper secondary, then lower secondary and lowest for primary education (assuming some cost recovery). If we assume no cost recovery, the highest private return is still for upper secondary education, then tertiary education, and the lowest is primary education. The only difference is that higher secondary becomes the second best profitable level, instead of coming third after lower secondary.

The general results obtained from using the elaborate method are that primary education has the lowest private rate of return, while upper secondary has the highest private and social rates of return. These results suggest that the most profitable level of education from both society's and individual's point of view is senior secondary. From society's point of view, the least profitable levels of education are primary and tertiary education levels. Tertiary education is the most subsidised level even though it is one of the least profitable from society's point of view. For the individual, primary education is the least profitable.

Table 6.28 *Annual Private and Social Rates of Return by Gender**

	Private Rates of Return		Social Rates of Return	
Education level	Male	Female	Male	Female
Primary	6.7	5.9	5.5	4.6
Junior Secondary	12	14	8.3	8.4
Senior Secondary	18.7	27.1	12.7	16.2
Tertiary Education	8.8(5.2)	15.9(8.9)	3	4.5

* The figures in parenthesis for higher education are rates that assume graduates contribute 5% of their original salary for a period of 4 years, being a form of cost recovery

6.3.2 *Private and Social Rates of Return to Education - Supplementary Survey Data*

Table 6.29 shows private and social rates of return calculated using the elaborate method. The private rates of return to education from the elaborate method are very similar to those reported in tables 6.19 and 6.24(for the private and pubic sectors). The returns are highest for tertiary education (26%), followed by upper secondary (17.7%), and lower secondary (6.2%). Primary education has the lowest rate of 0.94%. Social rates of return are however highest for upper secondary, followed by tertiary education and lower secondary is next. Primary education is still the least profitable level. For both the individual and society, primary education has the lowest profitability. For the individual, tertiary education is the most profitable level of education, while from society's point of view it is upper secondary that is the most profitable level.

An index of the subsidisation of education is also calculated and shown at the bottom of table 6.27. The index rises by level of education, being highest for higher education and lowest for primary education. The results imply that the most subsidised level of education is higher education and the least is primary education. Therefore the highest distortion between private and social rates happens at tertiary education level and the least is at primary education level.

The figures in parenthesis on the column for higher education are private, social rates and index of subsidisation calculations based on an assumption that there is some cost recovery in the form of students paying back 5% of their starting salary for the a period equivalent to the length of study of their programmes. We assume a starting salary of P2000.00 per month for someone graduating from a 4-year university programme. This gives a private direct figure of P4800.00 for the whole programme. This amount is

also subtracted from the subsidy, since its assumed to be a part paid out by the student. The result of this adjustments were to lower the private rate of return to tertiary education to 14.2%, making it lower than higher secondary. Upper secondary becomes the most profitable for both the individual and society, followed by tertiary education. The highest distortion is still at tertiary education level.

Table 6.29 *Annual Private and Social Rates of Return, All Workers- Elaborate Method (%)*

Education Level	Primary	Low secondary	High Secondary	Tertiary
Private Rate	0.94	6.2	17.7	27(14.2)
Social Rate	0.77	4	10.5	6.3
Index of public subsidisation*	22	55	68.6	328.5(125.4)

* The index of subsidisation measures the percentage by which the private rate exceeds the social rate

Table 6.30 below shows the private and social rates of return by gender. Assuming no cost recovery, the highest private return is for tertiary education, then upper secondary, and the lowest is primary education. If we assume that students pay back some of their costs of education upon graduation, the highest private rate for both sexes is that of upper secondary, followed by tertiary education. Senior secondary has the highest social rate for both sexes, while primary education has the lowest. Female workers have higher private and social rates for primary and secondary education than male workers. However, male workers have higher social and private rates for senior secondary and tertiary education than female workers.

The general results from using the elaborate method are that primary education has the lowest rate of return, both social rates and private ones. The highest private rates are either for senior secondary or tertiary education, depending on the assumption we make about cost recovery for higher education graduates. These results are very similar to those found from various Mincerian earnings functions (see tables 6.19 and 6.23). The most profitable level of education from society's point of view is clearly senior secondary. The annual private rates are lower than those from the Mincerian earnings function. This is to be expected, given that the elaborate method takes into consideration both direct and indirect costs of schooling.

Table 6.30 *Annual Private and Social Rates of Return by Gender**

	Private Rates of Return		Social rates of Return	
Education level	Male	Female	Male	Female
Primary	1.7	3.4	1.4	2.6
Junior Secondary	4.9	11.4	3.4	6.8
Senior Secondary	17.1	15.1	10.5	8.6
Tertiary Education	26.5(14.6)	21(10.2)	7.5	4.7

* The figures in parenthesis for higher education are rates that assume graduates contribute 5% of their original salary for a period of 4 years, being a form of cost recovery

6.4 *General discussion on Rates of Return to Education Results*

The general results from the previous analysis are that, using both the elaborate method and Mincerian Earnings functions of different types are that, the rates of return to education do not decline by level of education. They are highest for upper secondary or tertiary education, and lowest for primary. The general trend, based mainly on Latin American countries is for the rates of return to be highest for primary followed by secondary and then lowest for tertiary education. Our results also show that the rates of return to the two secondary school education cycles are quite distinct. Higher secondary education in all cases has higher private rates of return than lower secondary. These results point to a similar conclusion reached by Bennel (1996) that, if Pscharopoulos's aggregate rates of return are calculated with upper secondary and lower secondary being separated, the aggregate rate of return to upper secondary is, in fact, the highest and not primary education.

The rates of return to education figures from this study especially those from the supplementary survey and the elaborate method are quite low compared to those estimated by the 1984 USAID study. It is evident therefore that rates of return to education, both social and private rates, have been declining for especially lower secondary and primary education cycles. The falling rates are quite expected given the dramatically changing labour market conditions, particularly on the supply side. There was a significant increase in the supply of graduates (as proxied by total student enrolment) to the labour market, while job opportunities were not adequate. In other words, the rate of employment creation was not adequate to absorb all the graduates

entering the labour market. The latest figure on unemployment is estimated at 21% and is highest for those aged less than 25 years of age. It is also highest for those with 1-3 years of secondary education, followed by those with primary education (Republic of Botswana, 1996).

The result of this mismatch between supply and demand for labour was that competition for the few jobs became intense. The competition was further pushing for more demand for education at all levels, as obtaining better education qualifications than fellow job seekers became the principal means for securing employment. The labour market was also responding to these increases in supply of graduates by escalating minimum job requirements. The result was that school leavers were filtering down occupation hierarchies. For instance, jobs that were previously the preserve of illiterates and primary school graduates are now being competed for by secondary school graduates as they filter down the occupation hierarchies. These results are discussed in chapter four.

Workers with more education qualifications have been bumping from the labour queue those less qualified to get the job. If those with more education qualifications perform better on the job that those with less education, there is nothing wrong with this "bumping" phenomenon. But if the imbalance between supply and demand are massive, as has been the case in Botswana's economy, qualification escalation and related phenomenon of filtering down will become so pronounced that it becomes quite questionable that the benefits of this process outweigh its costs (Bennel, 1996: 190).

Although rates of return are generally low, primary education is the most affected. The private rates of return to the level of education are estimated to be less than 1%

(supplementary survey data) and about 6% (HIES data). These rates are quite low; even lower than the return to capital, which is usually about 7% or more[21]. What makes this rate so low is that the earnings differentials between those with primary education and those with no education are very small. The benefits to going to primary school are therefore very small. This is a result of a phenomenon we have already discussed that, the primary school graduates were being bumped out of the labour market to very lowly paying jobs including the informal activities. Primary graduates were mainly bumped out by lower secondary school graduates, whose supply (as measured by total enrolment) increased quite tremendously.

While lower secondary expanded at a very fast pace, upper secondary education expanded at a relatively lower pace. About 30% or less of the lower secondary completers got places into upper secondary (Republic of Botswana, 1993). The increase in supply for this group of graduates was therefore not that dramatic as compared to primary and lower secondary levels. It was therefore those upper secondary graduates who were obtaining an increasing share of the mainly skilled, middle level jobs that used to be the preserve of lower secondary school leavers. The additional cost of acquiring this privileged access to relatively few good job openings was usually only two more years of full time education. The net income benefits (as shown by the earnings differential between this group and the lower secondary school) are quite high. We also show from our data that this level of education has a high earnings premium. The result is therefore large rates of return to education than the other levels. However, the earnings

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[21] We are estimating the yield to capital by the nominal rate of interest.

differentials between this group and the lower secondary education group cannot be wholly attributable to any markedly superior human capital acquired by upper secondary school leavers. Part of these differentials may be a result of a straightforward process of screening (we discuss screening in the next chapter).

Tertiary education is also highly profitable, as shown in the results from the HIES data. This is mainly due to high earnings compared to earnings of those with upper secondary education level.

Generally rates of return to education increase by level of education. Apart from the changes in the labour market that we have already discussed, these results may have other major implications about education. First, that more able people obtain more schooling. The higher rates for higher levels will therefore be a result of higher ability. Second, that quality of education may be improving as one moves up the education ladder. However, our study does not measure changes in school quality and ability differences. We therefore we can not be more concrete about the changes in ability and school quality. A more important issue emanating from these results is that the British-type of schooling usually contain a strong filtering and screening mechanism through which more able students, or students from household in higher end of income distribution, transit up the educational hierarchy. Guisinger, et al (1984) make a similar point about the positive relationship between rates of return and level of education for Pakistan.

Finally, education in Botswana appears to exacerbate income inequalities. The high rate of return for higher levels of education indicate that the distance between the

earnings of the highest and lowest worker in the skill hierarchy is big, which may be the reason why Botswana has such a higher income inequality.[22]

[22] The 1993/94 Household Income and Expenditure Survey reports a gini-coefficient of 0.52, which is not a significant improvement as compared to 1985/86 that reports a gini-coefficient of 0.56.

CHAPTER SEVEN

THE SCREENING HYPOTHESES - SOME TESTS

CHAPTER SEVEN

THE SCREENING HYPOTHESES - SOME TESTS

7.1 *Introduction*

The general results obtained from calculating private rates of return using various Mincerian earnings functions are that the lowest returns to education in Botswana are for primary education and the highest returns are for higher secondary education and tertiary levels of education. Establishing this pattern of rising rates of returns to higher education raises an important policy question: are certain qualifications rewarded over and above years of education? The validity of the above analysis of the human capital model rests on the assumption that education, as measured by years of schooling, imparts various cognitive skills that increase workers' productivity. An alternative explanation is that formal education is primarily used as a screening device, and workers will compete for jobs by collecting credentials merely to signal their abilities to employers (Layard and Psacharopoulos, 1974). The result of such a process is the tendency for workers to overeducate themselves.

The first part of this chapter summarises literature on the screening hypotheses. We then present the results of the test for screening from our two sets of data. We test for the hypothesis by gender, type of employment and by type of organisation.

7.2 *The Screening Hypothesis*

A major challenge to the human capital model has been the screening hypothesis. The screening hypothesis comes in two forms, the strong version and the weak version. The strong version asserts that education merely identifies students with particular attributes, acquired either at birth or by virtue of family background, but does not itself produce or in any way improve these attributes (Blaug, 1985). The weaker version sees school as an index among others used by employers to sort out applicants given their lack of knowledge about the applicant's productivity. Blaug (1985) interprets the weaker version of the screening hypothesis as a label for a classical information problem in a labour market. The main challenge of the screening hypothesis (whether in the strong or weak) is to cast some doubt to the human capital's explanation of the relationship between earnings and education as implying that educated workers earn more because they have acquired some useful skill in school that make them more productive. The screenists argue that education simply confers a certificate, diploma or a sheepskin which enables a holder to get a well-paid job without necessarily affecting his or her productivity (Woodhall, 1987b).

The strong version of the screening hypothesis has been refuted in most empirical studies (for instance, Psacharopoulos, 1979a, Lamboropoulos, 1992). But the weak version has not been refuted since it is observed that employers do use educational qualifications in selecting employees. Blaug concludes by saying that " *if the difference between the two explanations is indeed that of discovering whether schools produce or merely identify those attributes that employers value, the empirical evidence that would be capable of distinguishing between them is presumably evidence about what actually*

happens in classrooms. However, both sides have instead looked to labour market data with which to assail their opponents" (Blaug, 1976: 848). The question, as he puts it, is not whether schooling explains earnings, but rather why it does (Blaug, 1976). Studies that try to look into what actually goes on in classrooms, however, find variables like grades, number of courses taken, all had insignificant effects on wages, especially for lower levels of education.[23] Woodhall (1987b) points out that the screening hypothesis has helped us recognise that education affects attitudes, motivation, and other personal characteristics, as well as providing knowledge and skills. The human capital model could therefore be made compatible with the weak version of the screening hypothesis by recognising that schooling does not only produce cognitive skills but also develops personality traits that are valuable to employers. It must also be recognised that such activities increase workers productivity in complex ways.

Weiss (1995) points out that " sorting models" (which is a term he uses to refer to both screening by firms and signalling by workers) can best be viewed as extensions of human capital models. The major differences between the two sort of models lies in the fact that human capital is concerned with the role of learning in determining the return to schooling. Sorting models, while allowing for learning, focus on the ways in which schooling serves as either a signal or filter for productivity differences that firms cannot reward directly. Sorting models, extend human capital by allowing for some productivity differences that firms do not observe to be correlated with the cost and benefits of schooling (Weiss, 1995: 133-135). Weiss sums up the argument

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[23] See Weiss (1995) for a further discussion of this literature.

that sorting models subsume all the features of human capital models by arguing that " *it seems unlikely that learning explains all the wage differences associated with schooling and work history. Better educated workers are not a random sample of workers: they have low propensities to quit, or be absent, are less likely to smoke... However, if low levels of education are associated with unfavourable employee characteristics, and employers are allowed to take education into account when hiring workers, we would expect employers to favour better educated workers as a means of reducing their costs of sickness and job turnover. In turn, students will take these hiring criteria into account when deciding how long to go to school.*" (Weiss, 1995: 133). But, if sorting models are so plausible and able to explain empirical regularities that are not explained by other models, why the resistance to using them? Weiss (1995) first argues that; sorting models are usually mistakenly grouped with credentialism, in which case education has no effect on productivity (which as already stated is not implied by the sorting models). Second, sorting models are pareto inefficient since the private and social returns differ. A related objection is that if the unobserved differences were important, firms would test for them directly, or workers would test themselves. The argument here is that there must be cheaper ways to learn about workers than schooling.[24]

Several ways of testing for screening have been suggested by Psacharopoulos. The first test is a comparison of the average rate of return between the competitive and non-competitive sectors of the economy. We expect lower returns in the competitive sector than in the non-competitive sector. This is because wages in the non-competitive

[24] Among the problems emanating from alternative solutions are the difficulty of both the structure of such tests and how to introduce them-it is generally an out of equilibrium move.

sector are often determined by the bureaucracy and linked to years of schooling. The years of schooling coefficient (which is the average rate of return to education) should therefore explain less of the variation of earnings in the non-competitive sector (Lambropoulos, H. S, 1992).

The second test involves an observation of age-earnings profiles. We expect the age-earnings profiles for different levels of education to converge. This is because employers are assumed to adjust downwards the earnings differentials of workers with more years of education, as information on individual worker productivity becomes available over time (Ziderman, A., 1992). Ziderman (1990) provides another test, where he introduces a dummy variable into an earnings function for those students who have completed and do have a certificate for an education cycle. Screening if present is expected to reduce the size of the coefficient on the years of schooling variable. We also expect the coefficient of the dummy for the dummy for completion of a cycle to be statistically significant.

7.3 Screening *versus human capital - Some tests using HIES data*

To investigate the extent of screening, we ran the Mincerian earnings function with a set of dummy variables for those who have completed a given level of education (i.e. have the credential for that level). The results of this specification are shown in table 7.1 and 7.2. Table 7.2 presents results with correction for selection bias. The analysis shows that including a set of dummy variables for qualifications improved the explanatory power of the model; the gain is seven percentage points in variance in log of earnings on the simple human capital model presented in part (a) of table 3.24. The gain is more pronounced for female workers, where the model's R square is increased by 9

percentage points compared to males whose increase is by 4 percentage points. For all workers, all the coefficients for the dummy variables with the exception of that for the dummy for those with a primary certificate are significant at the 1% level. This is also true for female workers. For male workers, the coefficient for junior certificate is not significant at the 5% level. The coefficient for the dummy for primary education is significant at 5% but has a negative sign. These results are true for both the model with correction for sample selection bias and that without the correction. The inclusion of these dummy variables also lowered the average rate of return by about half for all workers, falling from 16% to 8%. The decrease is more pronounced for female workers, where the average rate of return fell by about 50% with this specification of the model. The results suggest that many qualifications, notably completion of senior secondary and university degree are rewarded over and above the years of education. Junior secondary is rewarded over and above the years of education only for female workers. These results suggest that an element of screening is present among employers in the formal sector labour market in Botswana.

International studies on tests for the screening hypotheses present results that are quite different from country to country. Using census data from Israel, Ziderman (1990, 1992) report that the rates of education are higher in the non-competitive sector than the competitive sector, and thus supporting the screening hypotheses. While these results seem to support the screening role of education, it is not clear from the study whether the certification effect should be interpreted as the result of screening for ability or of pure credentialism. Gomez-Castellanos and Psacharopoulos (1990), using data from Ecuador show that, the returns to education are higher in the private sector than the public sector,

and thus supporting the productivity enhancing role of education and some screening for the public sector. Lambropoulos (1992) shows similar results for the Greek economy.

The results from this study from using the last test are very similar to those reported by Ziderman. Ziderman (1990) shows a considerable reduction to the size of the coefficient on the years of schooling variable, which is also highly significant, especially for younger cohorts. The meaning for these results is that, the certification variable does exert an independent positive influence on earnings, over and above the investment effect of human capital.

Table 7.1 *Earnings functions with completed schooling cycles dummies, all dependent employees and by gender (HIES Data)*[Ψ]

Variable	All	Males	Females
Constant	4.4 (75.3)	4.5 (65.8)	3.8 (43.3)
Years of education	0.93 (12.08)**	0.12(12.9)**	0.11(9.6)**
Primary Certificate	-0.16 (-1.3)	-0.25 (-4.2)**	-0.05 (-0.8)
JC Certificate	0.14 (2.2)*	-0.02 (-0.4)	0.33 (3.7)**
Cambridge Certificate	0.65 (7.4)**	0.27 (2.5)*	0.92 (7.5)**
Higher education	0.69 (5.3)**	0.9 (3.03)**	0.97 (5.3)**
Experience	0.075(15.9)**	0.088 (15.7)**	0.079 (11.7)**
Experience Square	-0.0011 (-11.2)**	-0.0014 (-11.9)**	-0.0013 (-8.4)**
Training	0.57(15.1)**	0.45(9.4)**	0.6(12.2)**
R square (Adjusted)	0.48	0.51	0.60
N	2891	1587	1304

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 7.2 *Earnings functions with completed schooling cycles dummies, all dependent employees and by gender (adjusted for selection bias) (HIES Data)*[Ψ]

Variable	All	Males	Females
Constant	5.6 (43.3)	5.3 (35.4)	4.2 (22.4)
Years of education	0.074 (9.3)**	0.10(11.7)**	0.10(8.3)**
Primary Certificate	-0.07 (-1.4)	-0.17 (-3)**	-0.03 (-0.4)
JC Certificate	0.18 (2.8)**	0.012 (0.16)	0.34 (3.6)**
Cambridge Certificate	0.56 (6.8)**	0.22 (2.3)*	0.89 (7.05)**
Higher education	0.3 (2.58)**	0.75 (3.03)**	0.86 (4.8)**
Experience	0.023(3.5)**	0.052 (6.6)**	0.063 (6.1)**
Experience Square	-0.00038 (-3.2)**	-0.00086 (-6.1)**	-0.001 (-5.6)**
Training	0.52(14.5)**	0.42(8.8)**	0.6(6.1)**
Inverse Mills Ratio	-1.05(-10.3)**	-0.86(-6.1)**	-0.29(-2.4)*
R square (Adjusted)	0.50	0.51	0.60
N	2891	1587	1304

Ψ Note: t-statistics in parenthesis.
**Significant at 1% level of significance.
* Significant at 5% level of significance.

7.4 Screening *versus human capital - Some tests using a Supplementary Survey data*

To investigate the extent of screening in the supplementary survey sample, we repeated what we did with the HIES data and run the Mincerian earnings function with a set of dummy variables for those who have completed a given level of education (i.e. have the credential for that level). The results are very similar to those reported for HIES and are shown in tables 7.3 and 7.4. The analysis shows that including a set of dummy variables for qualifications improved the explanatory power of the model; the gain is seven percentage points in variance in log of earnings on the simple human capital model presented in table 3.28. The gain is more pronounced for male workers, where the

model's R square increased by 9 percentage points. For all workers, all the coefficients for the dummy variables with the exception of the coefficient for the dummy for those with a primary certificate are significant at the 1% level. For female workers, the coefficient for junior certificate dummy is also not significant at the 5% level. The inclusion of these dummy variables also lowered the average rate of return by about eight percentage points. These results suggest that many qualifications (junior and senior secondary certificates, and university degree) are rewarded over and above the other years of education. This would suggest that an element of screening is present among employers in the formal sector labour market in Botswana.

Table 7.4 shows results of fitting an earnings function with dummy variables for qualifications between those who are self employed and those in dependent employment Those in dependent employment are divided into the private profit and non-profit sectors. The non-profit making group of employers is made up of the public sector, parastatal sector and the non-profit making private organisations. Some common characteristics of these three types of organisations are that profit making is not necessarily their overriding objective and competition either does not exist or its very minimal if it does exists. On the other hand, the private sector is characterised by usually stiff competition and profit making objective as an overriding objective.

The results of this analysis show that for the private sector, all coefficients of the various dummy variables, except that for primary school certificate are significant at 1% level of significance. For the non-private sectors, the coefficient for primary certificate and junior certificate are not significant at the 5% level. The coefficients for higher education and senior secondary are however, significant at the 1% level. These results

suggest that screening is prevalent in both the private and non-private sectors of Botswana's economy. In other words, education appears to count for more than simply improved productivity. It serves both a productivity-enhancing and labelling function, with the relative importance of each varying with the level of education and perhaps the type of curriculum studied. As expected, for the self-employed, all the coefficients for the dummies for qualification are not significant at 5% level of significance. This indicates that there is no screening for the self-employed.

Table 7.3 *Earnings functions with completed schooling cycles dummies, all dependent employees and by gender (SS Data)*[Ψ]

Variable	All	Males	Females
Constant	5.4 (77.04)	5.7 (66.25)	4.9 (48.16)
Years of education	0.04 (3.4)**	0.03(2.1)*	0.09(5.1)**
Primary Certificate	0.011 (0.15)	0.28 (0.29)	-0.1 (-1.1)
JC Certificate	0.37 (3.5)**	0.38 (2.71)**	0.24 (1.7)
CambridgeCertificate	0.81 (6.07)**	0.75 (4.3)**	0.56 (3.1)**
Higher education	1.27 (6.5)**	1.18 (4.7)**	1.0 (3.6)**
Experience	0.075 (10.2)**	0.05 (5.3)**	0.088 (8.5)**
Experience Square	-0.0013 (-5.05)**	-0.0006 (-2.0)*	-0.002 (-5.2)**
R square	0.55	0.53	0.61
N	934	483	451

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

Table 7.4 *Earnings functions with completed schooling cycles dummies, by sector (SS Data)*[Ψ]

Variable	Private(Profit)	All non- Profit	Self- Employed
Constant	5.3 (61.1)	5.15 (49.9)	4.9 (17.07)
Years of education	0.06 (6.6)**	0.06 (3.3)**	0.08(2.5)*
Primary Certificate	0.04 (0.37)	0.011 (0.089)	0.16(0.8)
Junior certificate	0.42(3.07)**	0.32 (1.9)	0.59(1.3)
CambridgeCertificate	0.93 (5.4)**	0.72 (3.4)**	0.45(0.94)
Higher education	1.43 (5.3)**	1.1 (3.8)**	0.97(1.07)
Experience	0.07 (7.1)**	0.08 (7.5)**	0.06(2.3)*
Experience Square	-0.0014 (-3.8)**	-0.0014 (-3.8)**	-0.0012(-1.8)
R square	0.46	0.60	0.25
N	499	435	92

Ψ Note: t-statistics in parenthesis
**Significant at 1% level of significance
* Significant at 5% level of significance

CHAPTER EIGHT

POLICY IMPLICATIONS FOR THE DEVELOPMENT OF SCHOOLING IN BOTSWANA

The results from this study have the following policy implications for education and the labour market in Botswana:

Policy implication No.1

The rising pattern of education subsidies and private rates of return to education by level of education suggest that there exists some room for private financing at university level and upper secondary education levels. A shift of part of the cost burden from the state to the individual and his/her family is not likely to create a disincentive of investing in upper secondary and higher education given the high private rates of return to education for these levels of education. Woodhall (1988) suggests that shifting of part of the cost of upper secondary and higher education to either the beneficiary or their parents has the following advantages:

(a) in the long run, there might be a reduction of costs of subsidising students, which would allow government to either expand the other levels or reduce public expenditure on education;

(b) there will be less transfer of income from low-income tax payers to those who are likely to enjoy higher than average incomes in the future;

(c) there might be an improvement in motivation of students since they might become more cost conscious and more thoughtful about their education.

A major problem with shifting education financing to the individuals and their parents is that the costs of education might end up discouraging low-income students

from going to upper secondary and university education. This would not be a problem as long as students from poor families could be identified for scholarship awards.

The form of cost sharing at upper secondary school level might be in the form of modest school fees. However, as noted above, the fees might lead to a high dropout rate out of secondary education. A study on this aspect by Atta, Acquah and Tsayang (1996) shows that demand for secondary education in Botswana is inelastic and therefore recommend a fee of not more than P100.00 per term in the initial period.

The form of cost sharing at post-secondary education level can be in the form of student loan (as is presently the case for university financing). However, the loan system has got its own problems. One such problem is that the loan scheme does not necessarily reduce costs immediately to the taxpayer or government. Student loans might also be difficult to administer and also the default rate might be very high leading to no savings of public funds.

One alternative to the student loan system is to have a graduate tax system, which is thought of to be easier to administer as it works on the same principle as an income tax. A major problem with this system is that it assumes all graduates get employment, which might not be the case for Botswana in the future. There is therefore a need for research into the most feasible form of cost sharing at post-secondary school level. Student loans might not necessarily be the best method given the above mentioned problems with the loan grant.

Policy implication No. 2

From a pure cost-benefit analysis, the results of the rates of return calculations imply that top priority in terms of resource allocation should be given to upper secondary education as a form of human resource development. Both the social and private rates of return (HIES data) to education are highest for this level of education.

Policy implication No. 3

Lower secondary and university education levels are also socially profitable investments and therefore should be pursued alongside with upper secondary for balanced human resource development.

Policy implication No. 4

Even though the rewards from primary education are low for both the individual and society we still need to pursue it alongside other levels. This is for a number of reasons. First, there are numerous benefits to primary education that the economic approaches, including the one adopted in this study, fail to capture. Examples of these non-monetary rewards are; the effects of primary education on family size, health, nutrition, literacy, political awareness and awareness of national culture[25]. Moreover, the benefits to primary education are captured as benefits to the other levels of education for those who go beyond primary education.

Second primary education can best serve equity, since a majority of the poor do attend at least this level of education. Third, primary school level is a foundation to all the other levels. Fourth, given that this study has shown equity to be an issue, we do

[25] For more details on this literature see Colclough, 1982.

recommend the continuation of universal education for the primary level. Given that education and therefore employment are highly influenced by family background it is necessary to have government fund primary and lower secondary education. We recommend a continuation of the present system of having universally free 10 years basic education.

Policy implication no.5

Given the high unemployment rates for especially primary and junior secondary school leaver and the lower level of rates of return to these levels of education, there is need to make the curriculum more suitable for the current problem facing graduates from these two levels. While the curriculum should prepare students for further academic education, there is need to cater for those who will not make it into further academic education or those who would move into vocational education. There is therefore need for the curriculum to have built into it the practical subjects (e.g. agriculture, business subject, design and technology etc). The Ministry of Education is pursuing part of this recommendation, but there is need to make follow-ups to make sure that the policy has the desired effects. It is also necessary to have input from potential employers as to the necessary skills they need from primary and secondary school leavers.

Policy implication No. 6

As Botswana's economy developed and the education system expanded the rates of education were falling. This was mainly due to a mismatch between demand and supply for labour. If supply continues to outstrip demand we would expect the rates of return to fall further in the future. The high profitability of upper secondary education

might for instance not be sustainable, as tertiary education graduates will be bumping them out to lower paying jobs as the job market tightens up.

As educational qualifications continue to be devalued in the labour market, there is likely to be (as it is already evident) increased pressure for more places at the upper secondary and tertiary education levels. Some governments normally respond to such pressures by expanding those levels of education as well. A fact that must be reckoned with is that such an approach just postpones the real problem. As Kann et al. observe; giving people additional education does not itself create jobs (except for the teaching staff); jobs are created by investment, by government job-creation policies, etc., not by expanding schools (Kann, et al. 1988: 127). This therefore means that employment creation has to be pursued very vigorously. Government probably needs to become directly involved in job creation instead of its present policy of relying on the private sector while providing financial aid in the form of loans and grants.

Policy Implication No. 7

The results show that equity is an important issue to consider in implementing cost reduction or cost-sharing schemes in education. Parental background as measured by either the education of the head of the household or the education of the father was shown to be an important determinant of schooling and earnings. It is therefore important that a system to identify those from poor backgrounds be put in place. This will enable government to identify those eligible for bursaries when school fees are instituted at upper secondary level. Putting up such a system and actually making it effective has a number of problems. Woodhall (1988) rightly points out that there is usually lack of accurate data on family income, a difficulty of defining "family" where patterns of

"extended family" are common and even problems of measuring income in a partly subsistent economy. Despite these potential problems, we suggest that involving people working at the community level like welfare officers and social workers can best do this.

Policy implication No. 8

When most developing countries including Botswana became independent in the 1960s they were facing acute shortages of local skilled manpower. To reduce dependence on expatriates, the rational response was to produce enough Africans with school certificates and degrees to localise existing jobs and meet the annual requirements of the growing economy. The end result has been to produce more graduates than the economy could absorb, especially those with primary and lower secondary education. We now need to move away from massive production to production that is largely based on the needs of the economy. A study aimed at calculating rates of return to education for different disciplines might guide us in our prioritisation.

Policy implication No.9

This study has shown that the average rate of return to education to those in self-employment is almost equal to that found for employees in dependent employment. Given this results and the fact that the formal sectors cannot absorb all the people in the labour market, there is need for government to support the self-employed. This support can be in various forms including financial assistance, procurement of markets, training etc. There is therefore a need to come up with informed policy to support self-employment as an alternative to formal employment.

Policy implication No.10

It is evident that there is some discrimination for women from this study. We were unable to establish as to whether the source of discrimination is at the family level or in the labour market. At the family level this might be due to certain stereotypes about gender roles, while in the labour market there might be certain barriers for entry into some jobs for women. There is need for further research into the question of why women choose occupations that pay lower than their male counterparts. This study recommends a more detailed study into gender discrimination in Botswana's labour market.

Policy implication No.11

These results indicate that education in Botswana is not income equalising. This is implied by a pattern of rising rates of return by education level and a high correlation between earnings and family background. Thus the need to share the costs of education with the beneficiaries for upper levels of education. We would also need to identify those that would genuinely need a bursary for higher secondary level.

Policy implication No.12

This study has established that screening is prevalent in the private, parastatal and public organisations in Botswana. The implication is that workers will have a tendency to overeducate themselves in order to secure a job in the labour market. If education is purely a signal, then growth in the economy's stock of education has not increased the productivity of the work force. This means more resources are being devoted to rent-seeking with no gain to the economy. This is usually an outcome of labour markets that are non-competitive. This is not surprising given the Botswana government's role in wage setting through the Incomes Policy. The Revised Incomes Policy of 1991's move to

leave the earnings in the private sector labour market to be determined by market forces is likely to enhance labour market competitiveness and therefore reduce screening. But it is very unlikely that screening would be reduced tremendously given high unemployment rates, increased supply of labour and the tendency for the labour market to adjust to the imbalances by raising minimum requirements for jobs.

CHAPTER NINE

CONCLUSIONS

The human capital model explains quite a substantial part of the earnings determination for the Botswana economy. The simple Mincerian earnings model explains 38%(HIES) and 47%(Supplementary survey) of earnings variations. An extension of the simple model by adding training, including dummy variables for each education cycle, and dummies for each year of education improves the fitness of the model quite significantly. However, some element of screening is also prevalent in Botswana's formal labour markets.

Earnings are highly differentiated by citizenship, gender, location, and type of organisation and education attainment and training. An important paradox is that females earn significantly less than their male counterparts, and yet they are on average more educated than them. Part of the explanation to this paradox is that there is an occupational segregation. Female workers generally occupy jobs that are less rewarding than their male counterparts. The public and parastatal sectors offer higher pay packages than private sector labour employment. Family background as measured by father's education or education of head of household is shown to be an important determinant of earnings. Those from favourable backgrounds generally earn more than those from poorer backgrounds mainly due to them having more years of schooling. Those who supply more hours in the labour market generally earn less than those who supply fewer hours.

Age-earnings profiles generally higher the higher the education level. They also diverge as the age increases. This implies that the relationship between education and earnings becomes much more strongly established at later ages. However given the fact that returns to education for recent cohorts have been falling quite significantly, such results may not be too correct.

Labour markets in Botswana have been characterised by some filtering down as labour market conditions changed. The consequence of this filtering down process has been a fall in rates of return to education especially for lower education levels. In general, those with higher levels of education, those much older and male workers are likely to locate in jobs ranked higher in the hierarchy of jobs. These jobs are also highly rewarding than those ranked lowly.

The private rates are higher in for upper secondary and higher education and lowest for primary education. This implies that there is presently a high demand for entrance to these levels of education. Given the tight competition in the labour market, which is usually in the form of education qualifications, the high demand for these levels of education is not that surprising. Private rates of return to education are generally higher for female workers than male ones. Part of the explanation is the lower forgone earnings of female workers. However, females have a lower private rate of return than male workers for upper secondary education. Private rates of return are higher in the public and parastatal sectors than the private sector. This results cast some doubt on the earnings enhancement role of education as postulated by the human capital model and points to some screening role of education in Botswana's labour market.

The private rates of return are higher than the social rates for all levels of education. The differences in private rates and social ones rise by level of education. This implies that subsidisation rises by level of education. This indicates that shifting of costs of upper secondary and tertiary levels of education from society to the individual and their parents is feasible. Private rates of return to education generally rise by level of education, being highest for upper secondary and higher education and lowest for primary education. The lower rates of return at lower education levels are a reflection of the "bumping out" phenomenon which resulted from an increasing supply of educated labour and a low demand for labour.

Table A1 Probit regression of employment status, all and by gender (HIES data)[#]

Variable	All	Male	Female
Intercept	-0.23(-3.3)	-0.47(-0.53)	-0.49(-3.9)
Age2 (25-34)	0.8(14.4)**	0.63(8.4)**	0.92(12.3)**
Age3 (35-44)	1.09(14.9)**	0.84(8.08)**	1.3(12.7)**
Age4 (45-54)	1.25(12.1)**	0.89(6.8)**	1.7(9.5)**
Age5 (55 +)	1.03(7.3)**	0.67(3.9)**	1.6(5.4)**
Primary	0.07(0.9)	0.037(0.45)	0.13(1.1)
Lower secondary	0.16(2.1)*	0.15(1.6)	0.26(2.1)*
High Secondary	0.31(3.3)**	0.29(2.3)*	0.4(2.7)**
Tertiary	1.4(4.9)**	1.5(3.6)**	1.5(3.5)**
Married	0.4(5.6)**	0.56(5.5)**	0.3(2.9)**
Log likelihood Ratio	646.02	283.02	380.02
Sample Size	4056	2144	1912

Note: t ratios are in parenthesis

* Significant at 1% level of significant

** Significant at 5% level of significance

Table A2 Probit regression of employment status, by location (HIES data)#

Variable	Urban Areas	Urban villages	Rural
Intercept	0.21(2.2)	-0.35(-3)	-0.26(-1.9)
Age2 (25-34)	0.88(11.4)**	0.69(7.6)**	0.43(3.4)**
Age3 (35-44)	1.1(10.5)**	1.0(8.1)**	0.88(4.8)**
Age4 (45-54)	1.3(7.8)**	1.2(6.9)**	1.1(5)**
Age5 (55 +)	1.3(4.8)**	0.68(3.1)**	1.3(4.1)**
Primary	-0.18(-1.4)	-0.05(-0.4)	0.052(0.4)
Lower secondary	-1.4(-0.9)	0.07(0.6)	0.2(1.3)
High Secondary	-0.48(-0.3)	0.04(0.2)	0.56(1.9)*
Tertiary	0.7(2.2)*	5.9(0.009)	1.5(3.5)**
Married	0.37(3.5)**	0.53(4.3)**	0.24(1.5)
Log likelihood Ratio	344.5	209.5	82.3
Sample Size	2180	1234	642

Note: t ratios are in parenthesis

* Significant at 1% level of significant

** Significant at 5% level of significance

Table A3 Probit regression of choice of location- Urban/ Rural (SS data)#

Variable	Coefficients
Intercept	0.79(3.5)
Age2 (25-34)	-0.14(-1.0)
Age3 (35-44)	-0.17(-1.1)
Age4 (45-54)	-0.26(-1.2)
Age5 (55 +)	-0.99(-2.6)**
Primary	0.23(1.2)
Lower secondary	0.14(0.7)
High Secondary	-0.014(-0.6)
Tertiary	0.02(0.9)
Married	-0.17(-1.3)
Log likelihood Ratio	17.73
Sample Size	934

Note: t ratios are in parenthesis

** Significant at 5% level of significance

Table A4 Probit regression of choice of employment (Self-employed versus employees (SS data)[#]

Variable	Coefficients
Intercept	-1.1(-4.4)
Age2 (25-34)	-0.13(-0.7)
Age3 (35-44)	0.05(0.24)
Age4 (45-54)	0.25(1.04)
Age5 (55 +)	0.78(2.2)*
Primary	-0.04(-0.2)
Lower secondary	-0.63(-2.8)**
High Secondary	-0.75(-2.6)**
Tertiary	0.69(-2.1)*
Married	0.35(2.5)*
Log likelihood Ratio	61.73
Sample Size	1026

Note: t ratios are in parenthesis

* Significant at 1% level of significance

** Significant at 5% level of significance

Table A5 Probit regression for choice of employment, government, private and parastatals (SS data)#

Variable	Government	Private	Parastatals
Intercept	-1.5(-6.4)	0.26(1.2)	-1.8(-6.1)
Age2 (25-34)	0.54(3.9)**	-0.3(-2.6)**	0.25(1.4)
Age3 (35-44)	0.75(4.7)**	-0.44(-3.2)**	0.31(.5)
Age4 (45-54)	0.88(4.1)**	-0.61(-3.1)**	0.24(0.8)
Age5 (55 +)	1.3(3.4)**	-1.1(-2.8)**	0.34(0.6)
Primary	0.053(0.3)	0.33(1.8)	-0.4(-1.6)
Lower secondary	0.54(2.6)**	-0.05(-0.3)	0.039(0.15)
High Secondary	0.84(3.6)**	-0.29(-1.4)	0.18(0.6)
Tertiary	0.99(4)**	-0.53(-2.2)*	0.18(0.6)
Married	0.18(1.5)	-0.17(-1.5)	0.014(0.8)
Log likelihood Ratio	91	74.1	26.7
Sample Size	934	934	934

Note: t ratios are in parenthesis

* Significant at 1% level of significant

** Significant at 5% level of significance

Earnings differentials and rates of education in Botswana Supplementary Survey Questionnaire

This Questionnaire serves the purpose of collecting data to be used for a study that is being done for a Ph.D. thesis at the University of Manitoba in Canada. The objective of this study is to generate information on the nature of labour markets and returns to education in Botswana. The results of this study will be used to generate policies for Botswana's education system. Your response to the questions below is very important to the successful completion of this study, and therefore the information you give us will be treated as highly confidential. We thank you in advance for using your valuable time to answer the questions.

A. General Identification.

1. Stratum ---------- { }

2. District ---------- { }

3. District Name ---------- { }

4. Block number---------- { }

4. Dwelling Number ---- { }

5. Household Serial Number ----- { }

6. Name of Household Head ----------

7. Name of Enumerator ----------

8. How many members of your household had positive earnings during the past 30 days ---------- { }

B. Demographic Particulars.

9. Head of Household ---------- { }

10. Sex of head of Household

——— 1. Male { }

———2. Female

11. Relationship to Head

—— 0. Head

—— 1. Spouse { }

———2. Son/ daughter

——— 3. Grandchild

——— 4. Parent

——— 5. Brother/sister

———6. Other relative

——— 7. Not related.

12. Age of Respondent ———————— { }

13. Sex of Respondent { }

—— 1. Male

—— 2. Female

14. Marital Status { }

— 1 Married

— 2. Living Together

— 3. Never married

— 4. Separated

— 5. Divorced

— 6. Widowed

C. Family Background.

15. What is the level of education completed by the head of the household —— { }

16. What level of education did your parents complete?

(a) Mother ———— { }

(b) Father ———— { }

17. What is/ was the occupation of your parents?

(a)Father ———— { }

(b) Mother ———— { }

18. What is the monthly earning of the head of the household? ——— { }

D. Education And Training.

19. Have you ever attended school?

—— 1. Yes { }

—— 2. No

20. If Yes, what is the highest level or grade attended ———— { }

21. What was the average yearly private expenditure on your education?

Primary Education ———— { }

Junior Secondary ———— { }

Senior Secondary ———— { }

Higher Education ———— { }

22. Have you ever received any training after school? { }

—— 1. Yes

—— 2. No

23. If yes, was the training related to the present job? { }

—— 1. Yes

—— 2. No

24. Describe type of training programme ———————— { }

25. Length of training ———————— { }

E. Experience on the job

26. How many years have you been working on the kind of job you are presently doing (this includes similar work done in other organisations in the past) ——{ }

27. What is the total actual number of years you have been working on this job and any other job? ———— { }

28. What is the total number of jobs you have had over your entire career? { }

F. Employment and Occupation.

29. For the past 30 days I worked as :

——1. An employee. { }

——2. Self employed.

——3. Self employed with one or more employees.

30. What sort of work did you do in this job ? Use two or more words to describe occupation. (If you did more than one job or work in the past 30 days, describe the main job, i.e. the job on which you worked more hours) ———— { }

31. How many hours did you work per month? ———— { }

32. Industry ———— { }

33. How would you classify your organisation/firm/work:

————1. Profit private { }

————2. Non- profit private

————3. Public

————4. Parastatal

34. Thinking about the last week when you worked, and taking into account all your jobs, did you work full time? (assume 35 hours or more a week to be full time)

——1. Yes { }

—2. No

35. If no would you like to have worked more hours than you did last week?

——1. Yes { }

—2. No

36. Why didn't you work longer? { }

————1. No more work available.

————2. Wasn't able to do any more hours.

————3. Other (specify reasons).

————4. Not Applicable

G. Income.

37. Cash income

Item	Amount (Pula
Gross Wage	
Back Pay/ bonus/ Overtime	
Car Allownace	
Business Income/ Profits	
Livestock Sale	
Other (Specify)	

38. Value of wages in kind.

Item	Amount (Pula)
Mealie Meal	
Other Food	
Clothing	
Blankets	
Other goods (specify)	

39. If main source of income is profits, what proportion of these profits would you have explicitly paid yourself as wages from your profits? ———— { }

40. What is your total income tax deduction per month? ————————. { }

_____.

Checked By _____ **Date** _____

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