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EDUCATION EXPENDITURE, HUMAN CAPITAL AND ECONOMIC GROWTH IN UGANDA:

TIME SERIES ANALYSIS (1962 – 2002)

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Dedication

To My Lovely Wife Violet Akurut

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List of Acronyms

ADF	Augmented Dickey Fuller Test
"A" Level	Advanced level of education
BoU	Bank of Uganda
CRS	Constant Returns to Scale
EGMs	Endogenous Growth Models
ECM	Error Correction Model
GDP	Gross Domestic Product
GFCF	Gross Fixed Capital Formation
IMF	International Monetary Fund
IRS	Increasing Returns to Scale
ISS	Institute of Social Studies
MOE	Ministry of Education
MFPED	Ministry of Finance Planning and Economic Development
MTEF	Medium Term Expenditure Framework
M2	Broad Money
na	Not applicable
NTC	National Teachers' Colleges
NGMs	Neoclassical Growth Models
OECD	Organisation for Development and Economic Cooperation
"O" Level	Ordinary Level of education
OLS	Ordinary Least Squares
PEAP	Poverty Eradication Action Plan
SAPs	Structural Adjustment Programmes
SR	Short Run
UBOS	Uganda Bureau of Statistics
UPE	Universal Primary Education
UTC	Uganda Technical Colleges
UCC	Uganda Colleges of Commerce
WDI	World Development Indicators
VAR	Vector Autoregressive Variable

Abstract

Human capital has been seen by many as one of the key determinants to economic growth. However empirical studies on the role of human capital especially education to economic growth have been contradictory.

In our paper we examine the question whether education expenditure translates in human capital and hence economic growth in the case of Uganda using a time series technique. Using descriptive statistics, cointegration, error correction model and regression analysis we find that there is both a short run and long run impact of education expenditures on economic growth in Uganda through human capital. In our study we examined the average years of schooling as a proxy for human capital and found it to be positive and statistically significant. In our empirical analysis we find that a one percent increase in the average years of schooling, ceteris paribus would lead to 0.38% increase in real GDP in the long run and 0.2% increase in real GDP in the short run.

CHAPTER ONE: INTRODUCTION

1.1 Introduction

The role of human capital in the economic growth process is historic in nature. It builds from the work of earlier economists such as Denison (1962), Schultz (1971), Blaug (1972) and others that emphasised the role education as a means of human capital formation. Several other studies on the relationship between human capital and economic growth build on from this. Research on economic growth gained a lot of ground in the 1980's with the work of Romer (1986) and Lucas (1988). In these studies economic growth, human capital and the role of human capital in economic growth took a centre stage. However more recent empirical studies have found differing results for example Barro (1991) and Gemmell (1996) find a strong relationship between human capital and economic growth. However, Benhabib and Speigel (1994) and Devarajan et al (1996) find weak or negative relationship between human capital and economic growth[1]. The relationship between human capital and economic growth is further complicated by the fact that many factors affect the process of economic growth such as political stability, trade policies, industrialisation policies, size of the labour force, investment in physical capital, inflation, financial sector development among others (Tallman and Wang, 1994)

Many developing countries including Uganda have taken bold steps to develop their human capital over a period of time, some as far back as independence to date. Besides, most of these countries have gone through different periods ranging from political stability, turmoil, structural adjustment and economic reforms. In the past close to two decades alone, many Sub-Saharan African countries have undertaken larger structural reforms in their countries which have had direct and implicit implications on human capital formation. Uganda is one such example that has been characterised by rapid economic growth in the 1960's, declining economic growth in the 1970's, recovery in the early 1980's and reforms and rapid economic growth from mid 1980's to date. It is worthwhile to study the effect of all these on the economic growth of a country like Uganda and that is what this paper sets out to do with a specific focus on human capital accumulation[2].

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[1] Details in this subject will be discussed in chapter 3

[2] Human capital is a broad concept that includes health, nutrition and education. In this paper we will take human capital to be synonymous with investment in education as proxied by average years of schooling. This is so because of the special focus and importance that the government of Uganda accorded to development of education in Uganda since independence therefore making it a crucial human capital

1.2 The Statement of the Problem

Ugandan economy has fluctuated over time with progressive growth in the early 1950's, declining growth in the late 1950's and rejuvenated growth soon after independence Okidi et al, (2004) attributed to growth in agricultural sector and food processing industries. After independence the growth rate of GDP was expanding at approximately 6.7 percent despite the population growth rate of 2.5 per cent per annum. This growth was also reflected in the education sector which had flourished above all other countries in the region (Odaet, 1990) due to the desire for manpower to fill the vacancies left by the colonialists.

This growth was however, hampered during the rule of Idi Amin Dada (1971 – 1979). The GDP fell at an annual rate of 2.6 percent coupled with an increasing population growth rate of 2 percent per annum. Terms of trade deteriorated, infrastructure was destroyed, monetary GDP declined by about 3 percent annually (Odaet, 1990). Odaet noted that there was inflationary build up, money supply increased at an average rate of about 30% between 1971 and 1981. Deficits expanded coupled by shrinkage in revenue base especially from foreign trade. Public services and parastatals were not spared, properties owned by Asians were expropriated and skilled and professional manpower were expelled. This had profound effects on human capital accumulation. Odaet (1990) also notes that funding to the education sector drastically declined. Education expenditure as a percentage of total expenditure declined from 15 percent to 14 percent between 1971 and 1978. As a percentage of GDP the resources allocated to the education by the private sector declined from 3.4 percent to 1.4 percent in 1978 as did the revenue base.

This experience had devastating effects on the entire economy, however, much more on human capital stock. Thanks to the Government of Tanzania, in 1979, the dictatorial regime was toppled. With support from the IMF and World Bank, the government of Uganda undertook reconstruction and rehabilitation work in the early 1980's and late 1980's saw Uganda embark on radical economic reforms (Mutebile, 2000). These reforms included stabilisation, liberalisation and budget reform. These reforms saw more resources going to the social service sector especially education and health. This was part of government policy and priorities outlined in the PEAP (1997) document.

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indicator. Further we assume that an educated labour force is better at creating, implementing, and adopting new technologies, thereby generating growth.

The education sector was the key beneficiary of these reforms. As a share of GDP both the recurrent and development expenditures increased about 3 fold in 13 years (1988/89 – 1999/00) from about 1.1 to 3.1 percent (Mutebile, 2000). This led to large real per capita education spending for the period 1988/89 – 1999/00. Given the fact the real GDP per capita increased by about 41 percent during that period. The reforms are argued to have increased real GDP growth rate averaging 6.3 percent per annum from 1986/87 to 1999/00(Mutebile, 2000)

Mutebile (2000) adds that Uganda has since sustained rapid and broadly based economic growth since it began implementing adjustment policies in 1987. He states that despite population growth rates averaging 2.9% per annum in this period, the sustained rates of real GDP growth have raised per capita output at an average rate of 3.3% per annum. The size of the economy more than doubled in real terms and real per capita output also rose by almost 53% during the same period (Mutebile, 2000).

This paper investigates whether increasing education expenditure did improve human capital stock and human capital stock accumulation translated into economic growth in Uganda. The research presupposes that there is a relationship between education expenditure and human capital stock accumulation and that the accumulation in the human capital stock translates into economic growth. The study spans from 1962 to 2002, in order to capture the effects of periods of prosperity, turmoil and reform.

1.3 Justification of the research

Several studies reveal that there is a relationship between economic growth and poverty reduction. Therefore at this point in time when all efforts are geared towards "making poverty history" and aware that economic growth is one of the factors responsible for poverty reduction, it is important to study the determinants of economic growth so as to get an insight into what factors of economic growth can account for the rate of growth in Uganda. There are several determinants of economic growth among which are rapid physical and human capital investment. These two are cited as the factors behind rapid economic growth among the Asian Tigers[3] (Amankwah, 2004). Amankwah (2004) also quotes Petri (2003) findings that high and rising endowments of human capital due to Universal primary education and secondary education also generated increases in skills

[3] Malaysia, Taiwan, Singapore, Thailand, Hong Kong

that triggered growth among the Asian tigers. This relationship will further be expounded in Chapter 3 of this paper.

The focus of this paper is not to generally study the determinants of economic growth but to specifically investigate the relationship between human capital stock accumulation and economic growth. The study will follow other earlier studies especially three recent studies by Musila and Belassi (2004), Amankwah (2004) and Tallman and Wang (1994). Musila and Belassi (2004) studied the impact of education expenditures on economic growth in Uganda while Amankwah (2004) studied the relationship between health and education recurrent expenditures, human capital stock and economic growth in Ghana and Tallman and Wang (1994) studied human capital and endogenous growth with reference to Taiwan. All these studies used time series data analysis.

Our study intends to adopt a similar approach used by these studies but is distinguished by the following features;

1. **Time period:** The Musila and Belassi (2004) study covered the period (1965 – 1999), the Tallman and Wang (1994) study covered period (1965 – 1989) and the Amankwah study covered the period (1970 – 2000). Our study will cover a longer period (1962 – 2002) over and above the three cases.
2. **Geographical focus:** Like Musila and Belassi (2004) we focus on Uganda, the other authors use other country cases.
3. **The focus of the study:** The Amankwah (2004), study used recurrent education and health expenditures data as proxies of human capital, while Musila and Belassi (2004) used average education expenditure per worker as a proxy for human capital and Tallman and Wang (1994) used educational attainment as a proxy for human capital. Our study uses both recurrent and development education expenditures not as direct proxies for human capital but as a tool to establish whether there is a link between education expenditures on human capital and instead of focusing on both health and education like in the Amankwah (2004) case, we focus on only education expenditures. As earlier stated, the study restricts the definition of human capital to education because of the special focus and importance that the government of Uganda accorded to development of education in Uganda since independence therefore making it a crucial human capital indicator.

We differ from the Musila and Belassi (2004) in that our study uses average years of schooling as a proxy for human capital instead of average education expenditure per worker used by Musila and Belassi and we also use simple statistics (correlations and scatter plots) to get an insight into the nature of relationship between education expenditures and the average years of schooling not used by Musila and Belassi. The econometric focus of the study is to examine the relationship between average years of schooling[4] and the changes in level of real GDP.

Tallman and Wang (1994) used the education attainment measure of the percentage of the population that is 6 years and above that have completed primary education, secondary education and tertiary education, whereas we take the average years of schooling not used by their study.

4. Our study takes into account the potential effects the Amin era (1971 – 1980) on human capital formation.

This study is very critical because there are several arguments presented for the rapid economic growth in Uganda. This study will contribute to this debate by examining the role of human capital on economic growth and explore whether it is a potential explanation of the growth story in Uganda.

1.4 Research Methods

This study adopts a time series technique for the empirical study. It focuses on a single poor but rapidly growing country case. The study uses descriptive statistics, simple statistical tests, and econometric methods making use of the cointegration and error correction model to investigate the relationship education expenditures and human capital and human capital stock and economic growth (real GDP) over the period (1962 – 2002). The study uses secondary data obtained mainly from various issues of Uganda Statistical Abstracts (1960 – 2004) published by Uganda Bureau of Statistics (UBOS), IMF Government Finance Statistics, IMF International Financial Statistics (2004), World Bank Development Indicators (2004) and World Economic Outlook (September 2000 - 2004), Penn world tables 6.1. Reference is also made to various Ministries of finance and education reports and strategies.

[4] Here in referred to as human capital

The empirical part of the study begins by running correlations between expenditure on education using scatter plots and simple correlations and human capital. The second part of the study uses econometrics to estimate the relationship between human capital and economic growth. It involves running a time series regression analysis making use of the co-integration techniques and Error Correction Model

1.5 Research Objectives and Hypothesis

The objective of the study is to establish the link between the effects of changes in education expenditure on human capital stock accumulation and human capital on economic growth in Uganda using time-series data (1962 – 2002) and to generate policy implications and recommendations for the government of Uganda

1.6 Research Hypothesis

There is a positive relationship between education expenditure and human capital stock and human capital stock and economic growth (real GDP) in Uganda

1.7 Limitations of the Study

The data may not be accurate since it has been collected from different sources. The paper also uses proxies for human capital stock which may not be a true reflection of human capital stock. However an effort has been made to ensure that the results depict the study objectives and research questions

1.8 Organisation of the Paper

The rest of the paper is organized as follows Chapter 2 gives an overview of the economic situation in Uganda with focus on education system, historic trends in economic growth, resource allocations, policy reforms and government policy over time. Chapter 3 presents the analytical framework as well as relevant literature review both theoretical and empirical for this study. Chapter 4 presents the theoretical and empirical model and estimation of the relationship of the education expenditures and human capital and human and economic growth. This chapter also includes the discussion of the findings. Chapter 5 gives the conclusion, policy implications and recommendations of the study

CHAPTER TWO: OVERVIEW OF ECONOMIC SITUATION IN UGANDA

2.0 Economic Performance of Uganda (1960's – 1986)

The economic situation in Uganda has evolved over time with cotton as a major export during colonial times, replaced by coffee in the 1950's. During this period the economy registered substantial growth mostly in agriculture with a contribution from the fledgling industrial sector, which emphasized food processing for export (Okidi, et al, 2004). This growth slowed in the late 1950s, as fluctuating world market conditions reduced export earnings and Uganda experienced the political pressures of growing nationalist movements that swept much of Africa as the countries fought for independence. According to Odaet (1990) for the first five years following independence in 1962, Uganda's economy resumed rapid growth, with GDP, including subsistence agriculture, expanding approximately 6.7 percent per year. He notes that even with population growth estimated at 2.5 percent per year, net economic growth of more than 4 percent suggested that people's lives were improving. By the end of the 1960s, commercial agriculture accounted for more than one-third of GDP. Industrial output had increased to nearly 9 percent of GDP, primarily as a result of new food processing industries. Tourism, transportation, telecommunications, and wholesale and retail trade still contributed nearly one-half of total output (Odaet, 1990)

Odaet (1990) also laments that although the government envisioned annual economic growth rates of about 6 percent in the early 1970s, civil war and political instability almost destroyed Uganda's once promising economy. He notes that GDP declined each year from 1972 to 1976 and registered only slight improvement in 1977 when world coffee prices increased. He notes that negative growth resumed, largely because the government continued to expropriate business assets, decline in foreign investments, inefficiency in public services and the parastatals, expropriation of Asian property and erosion of the stock of professional and skilled manpower. He also observes that terms of trade deteriorated which led to the fall of monetary GDP estimated at 3.1 percent per year between 1971 and 1981. The decline in the monetised economy was accompanied by a build up of inflationary pressure. This was coupled by scarcity of goods which steeply increased money supply at an average rate of 30 percent per year between 1971 and 1981, fuelled by budgetary deficits, and shrunk the revenue base, particularly from foreign trade (Odaet, 1990)

The economic and political destruction in the Amin years contributed to a record decline in earnings by 14.8 percent between 1978 and 1980 (Odaet, 1990). Odaet (1999) notes that when Amin fled from Uganda in 1979, the nation's GDP measured only about 80 percent of the 1970 level. Okidi et al, (2004) state that industrial output declined sharply, as equipment, spare parts, and raw materials became scarce. They note that from 1981 to 1983, the country experienced a welcome 17.3 percent growth rate, but most of this success occurred in the agricultural sector. Little progress was made in manufacturing and other productive sectors. Renewed political crisis led to negative growth rates of 4.2 percent in 1984, 1.5 percent in 1985, and 2.3 percent in 1986(Okidi et al, 2004)

2.1 Economic Reforms in Uganda (1987 – To Date)

Growth in Uganda resumed in mid 1980's with GDP rising to about 4.3 percent above the 1986 average (Okidi, 2004). Okidi et al, attribute this to security improvement and resumption and expansion of production of factories that had stagnated. This modest rate of growth increased in 1988, when GDP expansion measured 7.2 percent, with substantial improvements in the manufacturing sector. In 1989 falling world market prices for coffee reduced growth to 6.6 per cent and a further decline to 3.4 percent growth occurred in 1990, in part because of drought, low coffee prices, and a decline in manufacturing output (Okidi et al, 2004) These changes in economic growth were associated with radical economic reforms that Uganda embarked on in the late 1980's after a long period of economic decline and civil strife. These reforms were driven by the World Bank and IMF.

2.1.1 The Main Components of Economic Reforms in Uganda

Uganda was one of the sub-Saharan African countries that implemented the structural adjustment and economic reform programmes with advice from the World Bank and IMF on a sustained basis and managed to generate a robust growth (Musila and Belassi, 2004). Musila and Belassi note that since 1995, the Ugandan government has increased the shares of education and health in its budget and that this was accompanied by a remarkable economic growth[5].

The economic reforms implemented in Uganda are in three main categories namely stabilisation, liberalisation of Markets and Structural Adjustment and Public Expenditure Reform.

[5] This will be explained in the next section as we explore the effects of the reforms on Uganda's economy

2.1.1.1 Stabilisation

According to Mutebile (2000), Uganda implemented macroeconomic stabilisation policies, mainly through strict control over public expenditure. He notes that in the 1970s and 1980s Uganda suffered from severe macroeconomic imbalances, including high rates of inflation and balance of payments deficits, because the growth of nominal aggregate demand consistently outstripped the growth of real supply in the economy which he attributes to printing of money to finance public sector deficits. Yet in an economy with a very shallow financial sector, even relative modest Government deficits which are financed by domestic credit creation can lead to a large percentage increase in money supply, which fuels high rates of inflation. Macroeconomic stability was restored in 1993 only when Government imposed strict control over its own expenditures and maintained fiscal discipline (Mutebile, 2000).

2.1.1.2 Liberalisation of Markets and Structural Adjustment

As earlier on stated by Odaet (1990), in the 1970s and 1980s the Ugandan economy was subject to a plethora of controls which severely distorted resource allocation and destroyed incentives for productive activity. These included according to Mutebile (2000) the controls on coffee marketing together with the overvalued exchange rate which meant that the farm gate prices which coffee farmers received for their coffee fell to levels which made coffee production unprofitable. Mutebile (2000) notes that since the early 1990s Uganda has implemented reforms to liberalise markets in all key sectors of the economy including the foreign exchange market, coffee marketing, financial markets and the tax system. As a result external trade regime has also been liberalised with the removal of all non tariff barriers to imports and the reduction and rationalisation of tariff rates. In addition, Government has implemented a privatisation programme to divest itself from commercial enterprises. The objective of these reforms was to improve the efficiency of resource allocation and free up opportunities for private sector investment (Mutebile, 2000).

2.1.1.3 Public Expenditure Reform

The government also pursued budgetary reforms which were aimed at improving the efficiency of Government expenditure and prioritisation of government expenditures on poverty eradication. This was done through introduction of a Medium Term Expenditure Framework (MTEF) in which budgets are determined within a rolling three year

framework (Mutebile, 2000). This was aimed at concentrating government expenditures on the provision of public goods and services that could not be provided by the market. As a result public spending was directed to the priorities namely primary education, primary health care, water and sanitation, rural roads and agricultural extension as set out in the Poverty Eradication Action Plan (PEAP), 1997.

2.2 The Impact of Economic Reforms on Growth in Uganda

Uganda has sustained rapid and broadly based economic growth since it began implementing adjustment policies in 1987. According to Mutebile (2000), real GDP growth averaged 6.3% per annum during the 13 years between 1986/87 and 1999/2000, the sustained rates of real GDP growth have raised per capita output at an average rate of 3.3% per annum despite population growth rates averaging 2.9% per annum in this period (see table 1 below) and the size of the economy has more than doubled in real terms and real per capita output has risen by almost 53% (Mutebile, 2000). Further according to Mutebile (2000)[6] investment rates increased. In real terms he notes, fixed investment increased by 90% during the 1990s, averaging 17.6% of GDP in the second half of the decade. They observe that although the initial increase in investment was attributable mainly to Government investment funded by donor project aid, private investment rates increased strongly during the 1990s and accounted for 70% of total investment by the end of the decade. Private investment averaged only 5.4% of GDP in the late 1980s, but rose to an average of 8.6% of GDP in the first half of the 1990s and 12.2% of GDP in the second half refer to (table 1) below.

Table 1: GDP Growth, Private Investment and Inflation in Real terms: 1986/87-1999/00

Years	GDP Growth (%)	Per capital GDP Growth (%)	Private Investment (%of GDP)	Inflation (%)
1986/87	3.8	1	5.4	216.5
1987/88	7.6	4.8	5.2	167.9
1988/89	6	3.1	5.7	130.5
1989/90	5.8	2.8	6.9	45.4
1990/91	5.2	2.2	8.3	24.6
1991/92	3.1	0.2	9	42.2
1992/93	8.4	4.5	9.1	30
1993/94	5.4	2.2	9.9	6.5
1994/95	10.6	7.3	11.2	6.1

[6] Supported by Okidi et al (2004)

Years	GDP Growth (%)	Per capital GDP Growth (%)	Private Investment (%of GDP)	Inflation (%)
1995/96	7.8	4.7	12.5	7.5
1996/97	4.5	1.7	12.8	7.8
1997/98	5.4	2.7	11.5	5.8
1998/99	7.4	4.7	13	-0.2
1999/00	5.1	2.5	Not available	6.2

Source: Mutebile (2000)

The table above shows that the policy reforms which stabilised the economy and liberalised markets contributed to the increased private investment. We can also observe from that table 1 that since 1992/93, when inflation was brought under control through the restoration of budgetary discipline, consumer price inflation has averaged only 5.7% per annum. Private investment rates jumped by about three percentage points of GDP, with a relatively short lag of about two years after inflation rates had fallen, which suggests that economic stabilisation can generate significant real gains.

Fox (2004), attributes the success of the reform process in Uganda to control of inflation and continued macro stability; trade and agriculture marketing reforms to increase producer prices at the farm gate, benefiting small holder farmers; improvements in public security, the rule of law, and investment climate which made Uganda a better place to invest than previously; effective political, administrative, and fiscal decentralization which fostered a sustained focus on reaching the underserved in rural areas with public services. Luck with weather and high coffee prices in the 1990s and very low levels of civil unrest were part of the story as well, as were substantial and sustained foreign aid inflows.

Mutebile (2000) is pessimistic that this explanation accounts only for the initial strong recovery of the Ugandan economy in the late 1980s and the early 1990s, but not how the economy has managed to sustain GDP growth rates throughout the 1990s. He attributes the sustained growth rates, after the initial revival of the economy in the late 1980s, to substantial increases in the quantity of factor inputs, such as fixed capital, and/or improvements in the efficiency of resource allocation which boosted human capital stock overtime. This is what this paper aims to explore. The role of human capital in explaining sustained growth in Uganda

2.3 The Education System in Uganda

Education in Uganda dates back to 1890's. At independence from Britain in 1962, education in Uganda was more advanced than in neighbouring countries Kenya, Tanzania, Zaire and Rwanda (Odaet, 1990). Uganda has had two long term objectives in the education system since independence (Odaet, 1990);

1. Primary school expansion towards universal primary education
2. The provision of sufficient manpower of the quality needed to meet the skill requirements of the economy.

The implementation of these goals was severely hampered by the events in the 1970's, which affected all the sectors of the economy, including the education system. The education system suffered the effects of economic decline and political instability during the 1970s and 1980s (Odaet, 1990). A recovery programme was adopted in 1982/84 to reconstruct and rehabilitate the educational infrastructure where the government of Uganda emphasized that education in Uganda was a foundation for economic growth and central to the well being of the society as a whole[7].

2.4 Overview of the Education Sector and Reforms

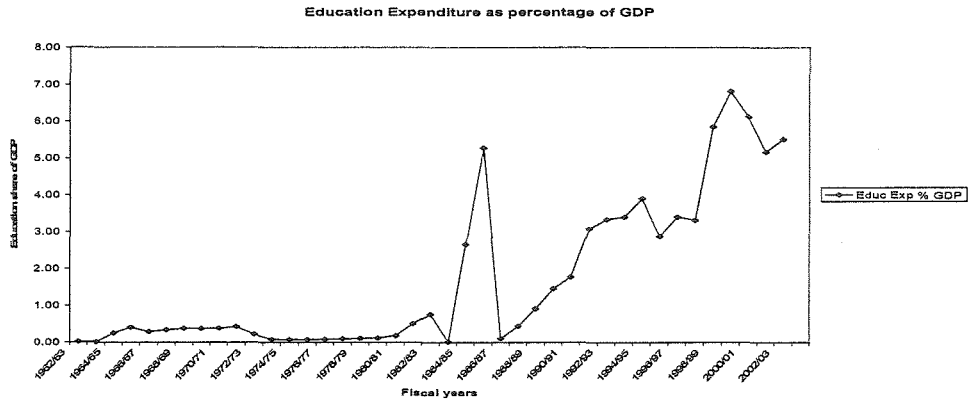
According to Aguti (2000), Uganda's education system has undergone tremendous changes since 1979 when most institutions in the country had virtually collapsed. She notes that the early 1980's, was devoted to the rehabilitation and expansion of schools and between 1980 and 1985, education accounted for an average of only 15.6% of recurrent government expenditure, reflecting its low priority at the time. However, since 1986 as observed by Nannyonjo, (2001), government expenditure on the education sector has risen steadily, and as of 2000, accounted for up to a third of total government discretionary recurrent budget. Nannyonjo, (2001) notes that between 1986 and 1996, primary school enrolment rose modestly from 2.2 million to 2.7 million and with the introduction of Universal Primary Education (UPE) in 1997, it jumped to 5.3 million, an increase of 94% in just one year. By 2001, the number had risen to 6.9 million. This development has not only transformed the entire education system in Uganda, it has also presented many challenges for Government, while at the same time opening up investment opportunities for the private sector Nannyonjo (2001) and Aguti (2000).

[7] Odaet (1990): implementing educational policies in Uganda, World Bank Discussion Papers, Africa Technical Department Series; Washington D.C.

2.5 Trends in Expenditures in Education in Uganda (1962 – 2002)

Budgetary reforms in Uganda involved a progressive reallocation of budgetary resources towards the education sector as illustrated in Graphs 1 and 2 which show the share of education expenditure in GDP and total government expenditure over the period 1962 – 2002.

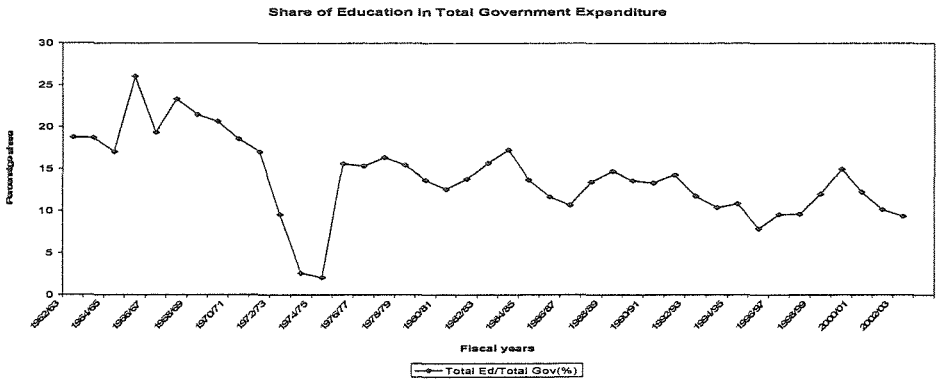
Figure 1: Education expenditure as percentage of GDP 1962 - 2002



Source: Own computation from UBOS statistical abstracts (1960 – 2003), Uganda Background to Budgets Issues (1976 -2003)

Graph 1 shows that there has been considerable increase in the share of education as a percentage of total GDP over time. This is remarkable from the period 1986/87 to 2000/01 which coincides with the period of economic reforms. A sharp increase was registered period 1984/85 perhaps because this was a period of infrastructural rehabilitation after the devastation from the Amin government. The decline observed in period 2001/02 could be due to general budget cuts by the government during that period.

Figure 2: Education expenditure in total government Expenditure (1962 – 2002)



Source: Own computation from UBOS statistical abstracts (1960 – 2003), Uganda Background to Budgets Issues (1976 -2003)

Graph 2 indicates that the share of education expenditure in the total government expenditure has not been stable overtime. It had has been cyclical in nature perhaps

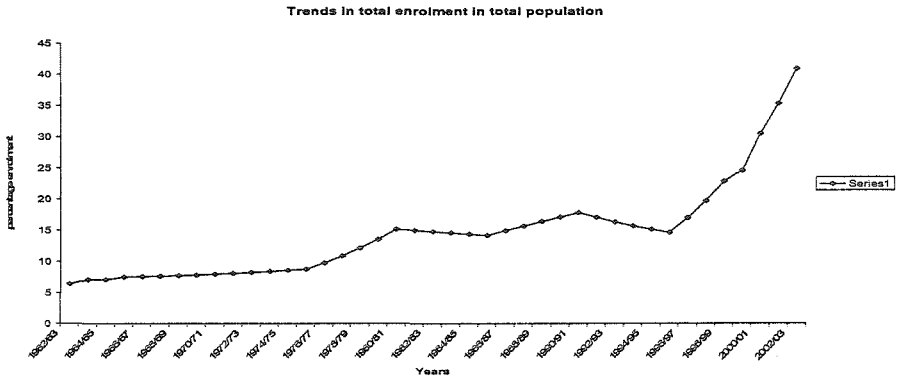
reflecting the history of the country that was associated with turmoil, rehabilitation and reforms and allocations of the budget for other purposes (changing government priorities).

The interesting observation is that much as the share of education expenditure in the total government expenditure is unstable overtime. The share of the education expenditure in total GDP seemed to have been rising from the period 1986/1987 to 2000 with occasional falls. The continued fall in 2001 to 2002 could be attributed to the general budget cuts in all sectors by the government during this period.

2.6 Trends in Education Indicators (1962 – 2002)

School education has continued to expand since 1962 when Uganda gained its independence from the British. The figure 3 gives enrolments in various institutions since 1962 to 2002.

Figure 3: Trends in enrolment (1962 – 2002)



Source: Own Computation from various statistical abstracts UBOS (1962 – 2002).

Graph 3 shows that enrolment in various education institutions has progressively grown through out the study period including the period of turmoil (1971 -1979), a steep increase in enrolment is observed from 1995/96 to date which could be largely accounted for by introduction of universal primary education in 1997, which accounts for about 7.2 million participants today.

2.7 Categories and Number of Education Institutions

There has been expansion in the educational institutions (between 1965 – 2000) in Uganda as shown in table 2; except for Uganda Technical Colleges (UTCs), National Teachers' Colleges (NTCs) and Uganda Colleges of Commerce (UCCs) whose roles

have been taken over by the University sector especially private Universities. Otherwise the primary schools have expanded from 2,580 in 1965 to 12,480, technical schools from 6 to 58, teacher training colleges from 32 to 64, secondary schools from 66 to 1,892 and universities from 1 to 9 in the period 1965 to 2000.

Table 2: Number of Institutions by Category (1965 – 2000)

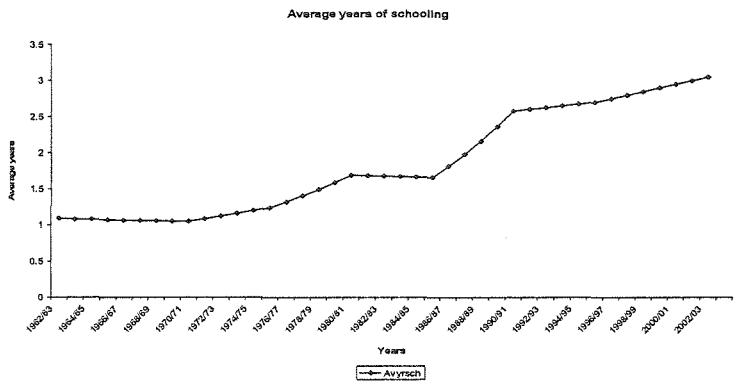
Institution	1965	1970	1975	1980	1985	1990	1995	2000
Primary School	2,580	2,755	3,184	5,564	5,586	7,667	8,531	12,480
Technical schools	6	5	5	5	55	52	58	58
Teacher training	32	26	30	30	92	65	64	64
Secondary school	66	73	73	73	213	510	619	1,892
Technical Institutes	2	2	2	2	4	4	4	5
Uganda technical colleges	na	na	na	5	5	5	5	5
National teachers colleges	na	na	Na	10	10	10	10	10
Uganda commercial colleges	na	na	na	5	5	5	5	5
Universities	1	1	1	1	1	3	7	9

Source: Own computation from various Statistical abstracts UBOS (1965 – 2002)

2.8 Average Years of Schooling

Average years of schooling as shown in graph 4 has modestly been growing from 1.1 in 1962 to 3.5 in 2002 for the population of 25 years and above. This implies a steady growth in human capital stock over the study period. This compares with graph 3 and table 4 indicating growth in enrolments and expansion of institutions respectively. This is attributed to the high value that Ugandans attach to education, government policy of universaling primary education and expanding labour force associated with expansion of expenditures on education by both government and private sector.

Graph 4: Average years of schooling 1962 – 2002



Source: Computation (interpolation) based on Barro and Lee Data set (2000)

2.9 Composition of Education Sector

Table 3: Number of schools or institutions, ownership status, and percentage in urban centres as at 2000

Education level	Number of Units	Ownership		% in urban centres
		Private	Government	
Primary School	12,480	3,293	9,187	20.2
Technical and vocational[8]	73	35	38	62
Secondary Teacher training colleges	10	0	10	40
Secondary school	1,892	1,291	601	70
Primary teacher training	64	0	64	20
Universities	12	8	4	60
Total	14,531	4,627	9,904	

Source: Own computation from Uganda statistical abstracts (various issues)

Table 3 compares the role and contribution of private sector to education provision and delivery in Uganda with that of the government. The government because of the Universal Primary Education (UPE) has heavily invested in primary schools owning about 9,187 of 12,480 schools, while the private sector on the other hand has complimented the government efforts by investing in secondary and University education institutions. The private sector owns 1, 291 and 8 secondary schools and universities respectively. However, most of these may not be affordable by rural poor since most of them that is 70%, 60%, 62% of the secondary schools, universities and vocational institutions are concentrated in the urban areas respectively. The government in its white paper (1992) however, recommends that technical education should be accessible to all who may not be able to access higher education.

This research seeks to examine the effects of these improvements in education on human capital stock and economic growth in Uganda.

[8] This includes Technical institutes, Uganda technical colleges, Uganda colleges of commerce, and technical schools

CHAPTER THREE: THEORETICAL AND ANALYTICAL FRAMEWORK

3.0 Background

Investment in education, knowledge and skills of citizens and its effective use is seen as a precursor to effective resource exploitation and means of achievement of social and economic development.

This was the centre piece of message of the "Human Investment Revolution" that dominated the economic literature in the 1960's. Roll (1941), pp 57-65 as in Blaug (1976) pp: 2 notes that human skills and knowledge accumulated via education is one of the most important mechanisms of increasing and developing national wealth. This is complemented by Adam Smith who equated an educated man to an expensive machine and also stated that "human resources are at the centre of economics and the actions that the society takes to nurture, develop and utilise its human potentials will largely determine its wealth and welfare" as in Ginzberg (1958), pp 15. Marshall in his work "the principles of economics" stated that "the most valuable of all capital is that invested in human beings" Marshall (1890), bk 6, ch.4, p469. This emphasises the origins and the importance of the concept human capital in the process of production and the wealth of a nation.

3.0.1 The Concept of Human Capital

There are different definitions of human capital. Viewing human beings as capital rooted in economic thought has been looked at by many economists including Adam Smith who viewed all the acquired and useful abilities of all inhabitants of the country as part of capital; Irving Fisher (1906) who looked at the concept of human beings as capital[9] and Thuman who argued that the application of the concept of capital does not impair his freedom and dignity as in Schultz 1971, pp 27.

Marshall (1890) however, did not believe in treating human beings as capital. Marshall rejected the notion of "Human Capital" and instead defined Capital as "all stored up provision for the production of material goods, and for the attainment of those benefits, which are commonly considered as part of income". Capital to him consists of knowledge and organisation: and of this some part is private property and the other part is not (Marshall (1890), bk. 4, ch. 1, pp 114 -115). The great influence of Marshall on the

[9] See Theodore Schultz, (1971) or Mark Blaug (1976)

economic thought contributed to the demise of the application of the concept of capital on human beings in the economic literature.

It only witnessed a revival in the U.S. economic journal in the 1960's as a result of many economists' efforts such as Schultz (1971) considered as the founder of the human capital theory[10] . Schultz observes that the failure to treat human resources explicitly as a form of capital, as produced means of production, as the product of investment, has fostered the retention of the classical notion of labour as a capacity to do manual work requiring little knowledge and skill.

Schultz (1971), pp 26 notes that by investing in themselves, people can enlarge the range of choices available to them and enhance their welfare. For him the concept of capital consists of entities that have the economic property of rendering future services of some value and should not be confused with capital as a fungible entity. In short to him the concept of human capital refers that the skills and the knowledge of human beings. This capital is in substantial part a product of deliberate investment. Schultz states that "the distinctive mark of human capital is that it is part of man. It is human because it is embodied in man, and it is capital because it is a source of future satisfactions, or of future earnings or of both". In other words no person can separate himself from human capital he possesses (Schultz 1971, pp 49).

3.0.2 Human Capital and Its Essence

As a result of a lot of work devoted by various economists, human capital theory has been articulated. Human capital is seen as an integral part of the neoclassical paradigm that aims at explaining the human behaviour in the economic environment. In its original form it was a product of neoclassical school of thought, which sought all foundations of social phenomenon in individual behaviour (Bowels and Gintis 1962, pp 73)

Uthoff and Pernia, (1986), pp 37 – 40 note that human capital theory views human skills and knowledge as form capital contrary to the traditional definition of capital based on "Marshall's concept" which dominated economic theory. Consequently to them human capital theory relates the future benefits and the current and past costs of human resources development as a criterion for investing in human beings.

[10] There are other intellectuals besides Schultz, who participated in articulating human capital theory such as Gary Becker, Denison, Mark Blaug, Stigler and Others.

The human capital concept was founded on some principal assumptions Schultz, (1971);

1. Rationality of persons in taking decisions of investment that enhances their capabilities.
2. Earnings of a person depends on their productivity which depends on the level of education and their experience
3. Differentials in earnings among persons can be attributed to their level of education
4. Allocation of investment resources to develop human capital should be on the basis of the rate of return of these resources in comparison with other alternatives

The effect of human capital accumulation on productivity and income is used for analysis at microeconomic and macro economic levels. At micro economic level, human capital approach asserts that human capital formation through good health; education and nutrition raise productivity of labour, which in turn influences economic activity and societal well being (Schultz, (1992) pp 150-152). While at macroeconomic level, new growth theories particularly endogenous growth models have been formulated relying on the utilisation of the concept of human capital to explain the main determinates of growth per capita income, such as the growth model by Romer (1986), Lucas (1988), and Barro (1990, 1995).

3.1 Measurement of Human capital

Human capital can be measured in terms of education level, health and nutrition. As far as education as a measure of human capital is concerned, several variables are used to proxy for human capital. The quantity of education is measured by years of attainment at various levels and the quality is gauged by scores on internationally comparable examinations (Barro 1990). Other proxies include enrolment ratios, adult literacy and education expenditures. For example Barro (1991), for 98 countries in the period 1960-1985, studies the relationship between the growth rate of real per capita GDP and initial human capital proxied by 1960 school-enrollment rates, Levine and Zervos (1993) uses students enrolled in secondary schools, Martin and Xavier (1997) uses a combination of various measures of education, Gemmell (1996) uses the measure of the workforce derived from school enrollment rates and the labour force participation data, Tallman and Wang (1994) use education attainment measure of the percentage of the population that is 6 years and above that have completed primary education, secondary education

and tertiary education, Benhabib and Spiegel (1994); Temple (1999) use average years of schooling. On the side of health the commonly used measure for human capital is the life expectancy measure for example Gallup et al. (1998) draws their variables from Barro and Lee (1993), and studies the relationship between initial levels of health and economic growth, using life expectancy at birth as their basic measure of overall health of the population. Nutrition is also occasionally used as an indicator of human capital. The next section discusses the methods used to estimate the impact of human capital variables or proxies on growth.

3.2 Methods used in the Measurement of the impact of Human Capital on growth

There are two main methods of measuring the impact of human capital on growth;

i. The growth accounting area and
ii. The rate of return analysis

3.2.1 Growth Accounting

Growth accounting is the main application of the neoclassical growth theory (Scott 1989, pp 71). Its objective is to break down the growth rate of the aggregate output into contributions from inputs, usually capital, labour and the level of technology (Barro and sala – i – Martin (1995), pp 346). As stated by Hicks "growth accounting" traces its origins to work done by Stigler (1947) Schmookler (1952), Kendreick (1961) among others, but the definitive work remains that of Denison (1967, 1974, 1979) as in Hicks, 1980, pp 4).

In growth accounting the analysis generally starts from a neoclassical production function in the style of the production function of Solow (1956). It equates the growth rate of aggregate output to the growth rate of the total productivity of factors of production plus a weighted average of the growth rates of two inputs.

There have been attempts to extend growth accounting to include factors like research and development (Barro 1995, pp 346 – 351) but the inability of the conventional studies via growth accounting to explain more than half of growth with help of factors such as labour and capital led to the discovery of the role of human capital in economic growth particularly after the "human investment revolution" in the late 1950's. Aukrust (1959)

attributed the unexplained proportion of growth residual to human factor, Denison (1962) estimated that 23 per cent of growth in per capita (employed) income between (1909 – 1929) in the United States could be due to education, and the corresponding figure was as high as 42 per cent during 1929 – 57 as in Tilak 1989, pp 11. Psacharopoulos (1984) using Denison's and Schultz's growth accounting equations, argued that for 29 countries, the contribution of education to economic growth ranged between 0.8 percent in Mexico and 25 per cent in Canada and the simple average was 8.7 per cent[11].

3.2.2 The Rate of Return Analysis

The rate of return is used to determine the role of investment in human capital on life time earnings and economic growth at micro level. The rate of return analysis consists of estimating the rate of return from investment in education, based on measuring life time earnings of people of various education levels. The benefits are discounted and compared to the private and social costs of education, including foregone earnings while at school, to estimate the rate of return from the investment in human capital (Hicks, 1980). Micerian earnings function is the basic empirical model for measuring the rate of return on education. Becker (1960) started the first more systematic attempt to estimate the rate of return to education after the human investment revolution (Becker, 1964).

On the whole, although there have been two essential frameworks by which the relationship between human capital and economic growth has been tackled it can be said that there is no restricted approach to tackle the existence of the issue

3.3 Main Criticisms of the Concept of Human Capital

Although, human capital is seen as the basis of human investment revolution in economic thought, since the emergence of this theory in the 1960's, the concept has faced a lot of criticisms. These criticisms can be distinguished into two; the ones that concentrate on theoretical and conceptual issues; and the others that concentrate on methodological issues.

[11] For details refer to Psacharopoulos (1984) "contribution of education to economic growth: International Comparison" in J.W Fredrick, ed. International comparison of productivity and causes of slow down. Cambridge: American Enterprise Institute pp 335 - 60

3.3.1 Conceptual and Theoretical Criticisms

Shaffer (1961) argues that there is little to gain and much to loose by the universal application of capital concept on man. He based this on the issue that investment in human capital is different from investment in non human capital because at least part of any one direct expenditure for improvement of man is not investment as the term is usually used i.e. it is taken for reasons other than the expectation of monetary return, it has no impacts on the future output but in contrary satisfies wants directly (consumption expenditure). To him it would remain a virtual impossibility to allocate a specific return to a specific investment in man. He notes that if it was possible to compute the part of man's income that results from a given investment in man expenditure, it would in most instances still be advised from the view of social and economic welfare to utilise the information thus obtained as exclusive or even the primary basis for policy formulation, public or private" (Shaffer, 1961 pp 1026 – 1035).

The Marxists criticise the theory of human capital in that it does not take into account the relevance of class and class conflict in its analysis because it restricts its analysis to the exogenously given individual preferences, raw materials (individual abilities) and alternative production technologies yet such issues as the wage structure, the individual attributes valued in the labour market, and the social relations of the educational processes can only be accounted for through an explicit class analysis. Marxists argue that schooling may influence the rate of growth positively or negatively which goes beyond human capitalist's notion of "labour quality" to its role in the extension and reproduction of the wage – labour system, to its capacity to attenuate class conflict and thereby to alter the rate of capital accumulation. The Marxists argue that the error in human capital theory lies in its partial view of production and its abstraction from social reproduction (Bowels and Gintis, 1975, pp75)

Welfarists have also criticised Human capital theory because of its strict application of the economic yardstick of profitability to the analysis of human Capital development. They argue that the process of human capital development through education and other elements not only imparts vocationally useful knowledge and skills but also affects attitudes, motivation and values, all of which determine the worker's productivity and their participation in the process of development Uthoff and Pernia (1986), pp 48. They further argue that this is at variance with the notion of the society welfare as also

embodying non economic values such as democracy, freedom and motivations (Blaug, 1972, pp 159 – 167)

3.3.2 The Methodological Criticisms

Human capital theory uses the estimation of the cost and the benefits of the available alternatives as a basis for a person or decision makers to determine the best way of allocating the available investment resources to enhance capabilities of the person. Several criticisms have been labeled against this methodology by authors like Uthoff and Pernia (1986), and Blaug, (1972).

They argue that the theory considers the number of years of schooling as an indicator that reflects the educational attainment but the notion of the numbers of years of schooling completed is to them a very crude measure of educational attainment which ignores the variation in the quality of schooling which can be measured by the number of hours per day the student spends in the school or the share of the student of the total expenditure on education or by other variables, Uthoff and Pernia (1986), pp 47 – 48. They also argue that there are other factors that affect the productivity of a person besides education level which are in most cases highly correlated with the educational levels. They therefore argue that it is difficult to satisfactorily isolate the pure effect of education.

Blaug (1972) criticises the process of using costs and benefits to estimate the rate of return because it ignores the externalities which can occur when the programmes of enhancing the skills of human capital. He argues that there are different factors that can not be measured as a flow of costs and benefits but which have a great effect on productivity of the persons in society yet they not considered in the economic calculations. He states that the direct benefits of education are quantitatively less important than the indirect benefits such as self esteem, political participation and dignity which are not taken into account in the process of calculating the social rate of return.

Blaug (1972), pp201 also notes that the calculations of the rate of returns depends on the projections of the future trends from cross-section evidence, and that neglects the historical improvements in the quality of education and indeed the future change in the demand and supply of educated manpower

3.4 Human Capital, Economic Growth and Growth Theories

This section utilises the broad and accumulated wealth of theoretical knowledge and literature about human capital accumulation on economic growth to discuss the relationship between economic growth and human capital accumulation. It focuses on the neoclassical and endogenous growth theories which pay more attention to the role of human capital as an engine of growth. It also discusses theoretical and empirical studies linking human capital to growth.

3.4.1 Neoclassical Growth Theories and Human Capital

Scott (1989), Barro and Sala – i- Martin (1995), Lucas (1988), Mankiw et al (1992), Schultz (1993), Hammond (1993) and Allessandro Pio (1996), regard the growth models developed by Mead (1961), Solow (1956), Swan (1956), Denison(1961), Cass and Koopmans (1965) as neoclassical growth theories. Therefore this will be our definition of the neoclassical growth theories. The most widely used aggregate production function by neoclassical growth models according to Scott, 1989 pp: 72 -74 is

$Q = f(K, L, A, t)$

Where Q = total output/income

K is total real capital stock (physical capital)

L is labour force employed

A is total land used and t is time

It therefore assumes that any increase in one of the factors whether K, L, A or t will result in an increase in Q. The increase that results from time (t) according to them, ceteris paribus is due to technical progress. If A (land) is neglected in this function, the production function can be re-written in the form:

$Q = f[K, L, A(t)]$

Where A (t) refers to the technological progress as a function of time

Following the above mentioned literature of economic growth, this function is widely used in the process of modeling in the form Cobb- Douglas production function

$Y = AK^{\alpha}L^{\beta}$

Where K is an input that can be accumulated (typically physical capital), L is non reproducible input (Labour), A is technological progress (Level of technology), and Y is total output.

3.4.1.1 Main Features of Neoclassical Production Function

The neoclassical production function assumes constant returns to scale, such that in the absence of technical progress if the quantities of labour and capital have undergone an increase of say 2 percent, then the output would increase in that proportion[12]. Since the model assumes that K and L are each homogenous, 2 percent more of K plus 2 percent of L yields 2 percent more of every input that is already there in the production function. This means that the marginal productivity of each input decreases as the stock of each input increases[13].

These properties of neoclassical production function reveal that the neoclassical growth theories restrict the analysis of growth to the short run, Alessandro Pio (1996). The neoclassical growth theories state that the long run growth rates, if they are not zero, are determined by exogenous non economic factors such as population growth and the rate of technical progress. Accordingly this implies that, any measures to promote growth can only enhance short or medium term growth rates (Alessandro Pio 1996, pp 3 – 7). In order to have positive per capita growth rates in the long run, the neoclassical growth model states that the economy should get exogenously more productive over time.

3.4.2 Endogenous Growth Models

3.4.2.1 Introduction

The rebirth of the growth theory was in the 1980's beginning with the work of Romer (1986); and Lucas (1988). Growth theory emerged with a new way of thinking which contrasted the earlier neoclassical models which were driven by exogenous technological progress and population growth.

Romer and colleagues endogenise technological progress (Romer 1986, 1990), Human capital (Lucas 1988), fertility (Becker, Murphy and Tamura, 1990) and even political decisions resulting from political processes. Put differently the factors that were treated historically in growth literature as exogenous become endogenous and the long run growth determinates became determined within the growth model hence endogenous models, Hammond and Rodriguez, (1993), pp 1- 7.

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[12] The Cobb-Douglas function used above can experience increasing returns to scale or decreasing returns to based on the summation of $(\beta+\alpha)$. If $\beta+\alpha) > 1$ then there are increasing returns and if $\beta+\alpha) < 1$ then it experiences decreasing returns to scale.

[13] This is clarified in many text books for details refer to Scott 1989, pp 75 and Barro and Sala – i- Martin 1995, pp 14 - 16

3.4.2.2 Main Features of the Endogenous Growth Models

The main features that distinguish endogenous growth models (EGMs) from the neoclassical growth models (NGMs) especially in relation to the role of human capital are based on the assumptions. The neoclassical growth models of Solow, Koopmans and others relied on the Cobb – Douglas production function with constant returns to scale (CRS) and decreasing returns to each of the inputs ($\alpha+ \beta = 1$, $\alpha<1$ and $\beta<1$) as in the simple form $Y = F (K, L)$, $Y= AK^{\beta} L^{\alpha}$, where a positive growth rate could not be sustained in the absence of exogenous population growth or technical progress. While population growth would provide the complementary factor such that off setting the decreasing returns to the accumulation alone, technical progress would constantly shift upwards the marginal productivity of capital, thus increasing output per capita (Alessandro Pio (1996), pp 5-6).

However, the endogenous models have removed one or both of these assumptions and can be distinguished in to two sets of endogenous growth models namely the endogenous Growth Models with Constant Returns to Scale which introduces the concept of broad capital (Alessandro Pio, 1996 pp 6-7), Barro and Sala – i- Martin (1995) and Robelo (1990) and the endogenous Growth Models with Increasing Returns in the works for example of Aulin (1992).

3.5 NGMs and EGMs and the Role of Human Capital: Theoretical Literature

This section reviews the various theoretical postulations by both the neoclassical and endogenous growth theories on the role of human capital on economic growth.

As already discussed, the NGMs treat human capital as a homogenous factor in the production function neglecting differences among human agents in skills and knowledge. Additionally they treat technical progress as an exogenous factor whose determinates are determined outside the model while EGMs on the hand have factored human capital as essential input into the production function.

In 1986, Romer developed an equilibrium growth model of endogenous technical change in which the engine of long run growth was seen as primarily the accumulation of

knowledge[14]. The Romer model assumed knowledge as an input in the production function and the model offered an alternative view of long run prospects of growth. The model postulated that in fully competitive equilibrium framework, per capita income can grow without bound, possibly at a rate that is monotonically increasing over time in which the rate of return of capital may increase rather than decrease with increases in the capital stock as a result of externalities resulting from human investment (Romer 1986, pp 1003 – 35).

Lucas (1988) likewise found out that neoclassical growth theory is unable to account for observed diversity across countries given the over emphasis given to technology as a major explanation for wide differences in income level and growth rates across countries, Lucas (1986), pp 13 -17. As a result he considered two adaptations of the neoclassical growth model in the style of Solow to include human capital with externalities in the sense that average human capital affects worker's productivity (the internal effect of human capital) in addition to the effect of his human capital. With this modification the model predicts that the difference among countries can be maintained as differences of the level of human capital among countries and in the second modification, Lucas (1988) considered only human capital as having external effects in that the average level of human capital also affects the productivity of other factors of production. Consequently, with many commodities "with different levels of learning by doing" and with international trade, it seems that producers do not take learning possibilities into account, but only maximise their returns according to immediate comparative advantage which result in very different paths of human capital formation via learning by doing.

This work of Lucas has very great influence on many of the subsequent works on growth models with respect to the role of human capital as stated by Schultz (1992) "one implication of Lucas' hypothesis was that human capital should be factored back into the aggregate production function, an empirical practice that was never fully accepted in growth theory literature in the 1960's" (Schultz, (1992), pp 146).

Stokey (1990) as in Behrman (1990) developed a model consistent with the East Asian experience of rapid growth in trade, in education and rapid change of composition of

[14] Infact his model relied on the idea of Kenneth Arrow on his model of "The economic implication of learning by doing" (1962)

output. She found out that the acquired level of human capital is the main source of product quality where labour with higher level of human capital produces higher quality products in contrary to those with low level of human capital that are unable to produce higher quality products. She considered human capital as the essential factor in determining the comparative advantage.

Barro and sala – i – Martin (1995) using a one sector model in form AK models, argued that it is possible to have long run positive growth without exogenous technical progress in contrary to the conventional neoclassical growth models. This resulted from the adoption of the broad concept of capital that includes physical and human capital. Using a two sector model of endogenous growth with special attention to the role of human capital they stressed that "an economy would recover rapidly to a war that destroyed primarily physical infrastructure but rebound on slowly from an epidemic that eliminate mainly human capital" (Barro and sala – i – Martin 1995, pp 2000 -1)

3.6 Education Expenditure, Human Capital and Economic Growth: Empirical Evidence

There is considerable evidence at the micro and macro levels that to support a link between education expenditures and human capital and human capital and economic growth. However, as shall be observed below, there are contradictions within these studies both at micro and macro levels. This section therefore explores what other studies have found out on these relationships.

At micro level, Bratsberg and Terrell (2002) find that immigrants from countries with higher public expenditures per pupil receive higher U.S. wages. Card and Krueger (1992) find that education quality positively influences wage rates. Krueger and Lindahl (2001), find that there is robust evidence of private returns to schooling but less support for a relationship between growth and changes in levels of schooling. Schultz (1992) and Becker (1993) showed that investment in education had great influence on earnings. Mincer (1974) as in Krueger and Lindahl (2001) showed the log of earnings is linearly related to individuals' years of schooling, and the slope of this relationship is interpreted as the rate of return to investment in schooling. This is supported Gary Becker (1964) and Becker and Barry Chiswick (1966).

However, Krueger and Lindahl (2001) argue that the available micro evidence suggest that the returns to education obtained for various reasons are more likely to be greater than the conventionally estimated returns to schooling. They cite for example studies that consider the effects of compulsory schooling or school-building projects (Kevin Lang (1993), effects of school resources (Summers and Wolfe 1977; Krueger 1999); and effects of preschool programmes (Rivkin, Hanushek, and Kain 1998) and raising incomes (Barnett 1992), differences in student backgrounds (Entwisle, Alexander, and Olson 1997, Dale and Krueger 1998). All these have greater rates of returns as compared to the conventional estimates for example by Mincer. This therefore implies that for several reasons the returns to education vary according what variables are studied at micro level.

On the macro front, according to Krueger and Lindahl (2001), two issues have motivated the use of aggregate data to estimate the effect of education on the growth rate of GDP. They note that the relationship between education and growth in aggregate data can generate insights into endogenous growth theories, and possibly allow one to discriminate among alternative theories and that estimating relationships with aggregate data can capture external returns to human capital that are missed in the micro econometric literature.

According to Krueger and Lindahl (2001) the neoclassical growth model of Solow 1956 did not give any special role to human capital in the production of output while the endogenous growth models assign a more central role to human capital. The role of human capital in endogenous growth models can be divided into two broad categories (Krueger and Lindahl (2001) namely; the broad concept of capital which assumes that sustained growth is due to the accumulation of human capital over time (Uzawa 1965; Lucas 1988) and the second category which attributes growth to the existing stock of human capital, which generates innovations (Romer 1990) or improves a country's ability to imitate and adapt new technology (Nelson and Phelps 1966) as in Krueger and Lindahl (2001) .

Other studies at macro level include Cullison (1993) and Barro and Sala-i-Martin (1999) who find a positive relationship between government education spending and growth. Zhang and Casagrande (1998) find that education subsidies improve growth in a cross section of developed and developing countries. Barro (1991) finds a positive correlation between education expenditures and economic growth. Gemmell (1996) finds both the

levels of human capital and their growth rates to be important determinants of economic growth. Musila and Belassi (2004) showed that education expenditure per worker had a positive and significant impact on economic growth both in the long run and short run. Gallup et al (1997) notes that a more efficient labour force through better education is likely to increase productivity from a given resource base

Like in the micro front, other researchers find either weak or no evidence that education or education expenditures enhance economic growth at macro level. Levine and Renelt (1992) conclude that government education expenditures are not robustly correlated with growth rates. Devarajan et al (1996) find negative correlations between the share education expenditures in government budget and economic growth in most of their estimates. Benhabib and Speigel (1994) find weak evidence of a relationship between changes in educational attainment of the labour force and economic growth.

As seen above there is conflict both within the micro and macro evidence as far as the role of education is concerned. The recent cross-country studies have found that economic growth appears to be unrelated to increases in educational attainment yet a great deal of micro econometric evidence indicates high returns to human capital investments in developing and developed countries alike. These contradictions may be caused by several factors. Temple (1999) indicates that the correlation between increased human capital and growth may sometimes be hidden in the cross-country data by a number of unrepresentative observations.

The first paper to highlight the weak correlation between growth and increases in educational attainment was Benhabib and Spiegel (1994). Another influential paper, by Pritchett (1997), has emphasised a similar set of results but using a different dataset and more extensive robustness testing. Some of the explanations to this conflict include measurement error in the first-differenced education data (Krueger and Lindahl, 1998) and the possibility that, in many developing countries, the highly educated are more likely to work for the state than in the private sector (Pritchett, 1997). However, Temple (1999) calls this explanation simplistic. He tresses this to one reason that simple cross-country regressions do not detect an effect of human capital because the effect could be hidden by a small number of unrepresentative countries, perhaps ones in which human capital accumulation has had little or no effect. He found out that in a sample of 64

countries, there is clear evidence that output growth is positively correlated with the change in educational attainment, even when one conditions on physical capital accumulation. He therefore concludes that simple application of OLS is sometimes an inappropriate way to estimate cross- country growth regressions, and results should always be accompanied by a careful exploration of sample sensitivity, given the likelihood of substantial parameter heterogeneity. He demonstrates the point using data and specifications from Benhabib and Spiegel (1994).

Several other explanations showing the contradictions can be found in Krueger and Lindahl (2001). They include among others measurement error, estimation over varying time periods, effects of initial level of education and heterogeneous country effects of education among others.

Our paper therefore in the next section uses macro economic data to estimate the effects of education expenditure on human capital and human capital on economic growth (real GDP) using the endogenous growth models based on Cobb Douglas aggregate production function in Uganda

CHAPTER FOUR: EMPRICAL ANALYSIS AND DISCUSSION

4.0 Introduction

The main objective of this chapter is to show that accumulation in human capital stock through increases in education expenditure can explain economic growth in Uganda. The analysis employed in this chapter covers the period from 1962 to 2002. This period is used in our study for the reason that most developing countries, including Uganda devoted a lot of resources to human capital accumulation during the period 1960 – 1985 and the period from 1985 till now is deemed the crisis of human capital formation and utilisation (Tallman and Wang, 1994). Further most developing countries including Uganda are experiencing high levels of unemployment among educated people and besides most of the developing countries have implemented SAPs because of debt crisis and poor economic performance

4.1 Education Expenditures, Human Capital and Economic Growth in Uganda (1962 – 2002)

This section employs simple statistical tests to try to establish the potential link between education expenditures and human capital accumulation and Human capital and economic growth in Uganda over the period 1962 to 2002.

4.2 Education Expenditure and Human Capital Stock (1962 – 2002): Simple statistical tests

Here we attempt to establish the link between education expenditures and four different potential proxies of human capital namely; average years of schooling, average education expenditure per worker, adult literacy and total enrolment as percentage of total population. The relationship is tested pair wise using scatter plots and simple correlations. The education expenditures are expressed as a percentage of GDP.

The scatter plots 5a to 5d(refer to annex 2) indicate a positive relationship between growth in education expenditures as percentage of GDP and human capital accumulation proxied by the four different indicators average years of schooling, adult literacy, average education expenditure per worker and total enrolment as percentage of GDP in Uganda for the period 1962 – 2002 and relatively speaking, the degree of association as indicated by simple correlations coefficients (r) are 0.69 for average years of schooling (figure 5a), 0.67 for adult literacy (figure 5b), 0.96 for average education expenditures per worker (figure 5c) and 0.62 for total enrolment as percentage of GDP (figure 5d) indicate that

there seems to be a positive association between the four variables with education expenditure as percentage of GDP for the period 1962 – 2002 giving indications that there is relationship between education expenditures and human capital accumulation. All the four proxy variables are transformed into logarithms. The slopes of all the variables investigated reflect that a unit change in education expenditures leads to considerable changes in average years of schooling, adult literacy, enrolment and average education expenditures per worker. This conforms to theory in chapter three which postulates that education expenditures are positively associated with human capital stock. For example a number of papers have formalized this link between government education spending and growth by building endogenous growth models where public education expenditures directly influence human capital accumulation and consequently affect long-run growth. Examples include Glomm and Ravikumar (1992, 1997, 1998), Eckstein and Zilcha (1994), Kaganovich and Zilcha (1999), Cassou and Lansing (2001) and Blankeanu (2003) as in Blankeanu and Simpson (2003). In other work, as cited in Blankeanu and Simpson (2003), public expenditures have an indirect growth effect by encouraging private investment. This feature is found, for example, in Zhang (1996), Milesi-Ferretti and Roubini (1998), Hendricks (1999) and Brauninger and Vidal (1999).

4.3 Human Capital and Economic Growth: Simple Statistical Tests

4.3.1 Human Capital Stock and Economic Growth in Uganda (1962 – 2002)

Aware that there is an association between education expenditures and human capital proxied by four different indicators, we conducted simple statistical tests to establish the relationship between human capital variables discussed in section 4.2 above and economic growth (real GDP). The results for these tests are shown in figures 6a to 6d in annex 3.

The scatter plots 6a to 6d, (see annex 3) indicate that there is a positive relationship between the level of human capital and the real GDP for the period 1962 – 2002 measured by the four proxies of human capital. In relative terms the degree of association is also indicated by simple correlations coefficients (r) which are 0.87, 0.78, 0.42 and 0.80 for the average years of schooling, adult literacy, average education expenditure per worker and total enrolment as percentage of total population respectively and real GDP for the period 1962 – 2002. In relation to the slopes we observe that unit changes in the human capital indicators are positively associated with unit changes in real GDP. For example a unit change in the average years of schooling leads to a 0.2 change in real

GDP as shown in annex C 6a above. These findings are therefore a pointer to what is discussed in Chapter 3 of this paper where we observed that there is both a theoretical and empirical evidence of the positive relationship between human capital stock and economic growth. These shown by studies like Barro (1991), Barro and Sala – i – Martin (1995), Zhang and Casagrande (1998) among others.

4.4 Human Capital and Economic Growth: Econometric Test

4.4.1 Introduction

This section uses econometrics to test the link between human capital accumulation and economic growth in Uganda for the period 1962 – 2002.

After simple statistical test and getting indications of positive association between human capital and growth we examine our hypothesis that human capital stock accumulation leads to economic growth and argue that increase in education expenditures play a role in motivating and supporting human capital accumulation and that the endogenous growth in human capital in turn generates growth. However, we note despite the growing literature, the results of existing cross-country studies present conflicting evidence so that the explicit effect on output growth from human capital remains inconclusive.

This paper adopts a time series empirical strategy to investigate the importance of human capital accumulation on economic growth but focusing on a single poor but rapidly growing country. We use this framework based on arguments presented by Tallman and Wang (1994);

i. Case study approach provides a more careful and an in-depth examination of institutional and historical characteristics of a particular country
ii. The use of the data set comprised of the most appropriate and high quality measures unconstrained by the need for measurement consistency across countries
iii. A more detailed exposition of the dynamic evolution of the economy

4.5 The Econometric Model Specification

4.5.1 Theoretical Model

This paper uses the Cobb Douglas aggregate production function similar to the one used by Aulin (1992), Tallman and Wang (1994) and Musila and Belassi (2004) albeit with

some modifications to establish the empirical link between human capital accumulation and economic growth in Uganda. We used the aggregate production because we also wanted to consider the traditional input measures of capital (K) and labour (L) in our analysis

The aggregate production function takes the form of;

$Y_t = AK_t^{\alpha}L_t^{\beta}H_t^{\gamma}$, (1)

Where Y_t is real income (i.e., real GDP),

K_t is physical capital,

L_t is the labour force

H_t is the total amount of human capital,

A is the technology parameter,

t is the observation subscript,

And α, β, and γ are parameters to be estimated.

Human capital in the Model is defined as follows:

$H_t = S_tL_t$ (2)

Where S_t is the average years of schooling

In this study we estimate the relationship that increases in average years of schooling is directly related to changes in the levels of real GDP. In section 4.2 we find that education expenditures are highly associated with average years of schooling with a coefficient (R^2) of 0.69, therefore for our econometric analysis we use average years of schooling as our proxy for human capital. This is based on the argument that education expenditures contribute to improvement in the years of schooling (human capital) and human capital stock leads to improvement in the levels of real GDP.

Substituting equation (2) into (1) gives;

$Y_t = AK_t^{\alpha}L_t^{\delta}S_t^{\gamma}$, (3)

Where $\delta = \beta + \gamma$.

Like in the Musila and Belassi (2004) case we derive our econometric equation for our empirical analysis from equation (3) above. Theory postulates that there is a positive

correlation between growth in output and increases in human capital stock. Our findings are expected to conform to theory.

Given the fact that the relationship between output and the three inputs in Cobb – Douglas production function above is non linear making it inconsistent with the use of the Ordinary Least Squares (OLS) hence the variables for our model estimation are transformed into natural logarithms to be compatible with the Ordinary Least Squares[15]. As a result we obtain a linearised Cobb – Douglas function in the form $\ln Y_i = \ln \beta_1 + \beta_2 \ln X_{2i} + \beta_3 \ln X_{3i} + \epsilon_t$ (Gujarati, 2003 pp 224). In this form the model becomes linear in the parameters $\beta_0, \beta_2,$ and $\beta 3$ hence a linear regression model.

The transformations of the Cobb Douglas transforms the coefficients β_2, β_3 and others into elasticity of output with respect to the specific inputs such as labour, capital and human capital measured as a percentage change in output (Gujarati, 2003 pp 224). The summation of $\beta_2 + \beta_3 + \beta_4$ gives information on the rates of return i.e. the response of output to a proportionate change in the inputs. Gujarati states that if this sum equals to 1, then there are constant returns to scale, if it is greater than 1 there are increasing returns to scale and less than one decreasing returns to scale (Gujarati, 2003 pp 224).

4.5.2 The Empirical Model

In this section we use Equation (3) in the theoretical model to enable us to relate economic growth to human capital stock using logarithmic transformation. We also add other variables deemed growth determinants in Ugandan Economy as shown in the model specification (4) below. Like Musila and Belassi (2004) we do not restrict our model to particular returns-to-scale on the parameters of the production but leave this to be sorted by the data.

Our econometric model for empirical analysis is in log-linear form;

$$\mathbf{LOGRGDP_t = a + \alpha LOGK_t + \delta LOGL_t + z\ LOGAVSCH\ t + mLOGm2GDP_t + hLOGOPEN_t + xD_{1t} + \epsilon_t} \quad (4)$$

Where:

LOGRGDP = log(Y) is the logarithm of output (real GDP);

LOGK = log (K) is the logarithm of gross fixed capital formation;

[15] Also see Musila and Belassi (2004) and Amankwah (2004)

LOGL = log (L) is the logarithm of total labour force;
LOGAVSCH = log (AVSCH) is the logarithm of the average years of schooling
LOGM2GDP = log (M2GDP) is the logarithm of level of financial sector development
LOGOPEN = log (LOGOPEN) is the logarithm of total trade as percentage of GDP (openness)
D_1= (D_1) is the dummy variable 1 controlling for period of political turmoil (1971-1980)
a, α δ, z, m, h and x are the parameters to be estimated;
ϵ is the error term; and
t is the observation subscript.

We examine the importance of human capital accumulation for economic growth in Uganda in equation (4) using annual data spanning the period 1962 to 2002.

4.5.3 Variable Description and Sources

There are various determinates of economic growth and below we outline the ones we deem relevant for our study.

Human capital measured in terms of education and health is of the determinants of economic and given that the purpose of our study is to examine the contribution of education (human capital accumulation) to economic growth we decide to examine the contribution of education to economic growth (level of real GDP) in Uganda. We use the average years of schooling as a proxy because it is seen as the ultimate outcome of any education process. The data set for our analysis was obtained from the Barro and Lee database (2000) for the variable of average years of schooling. The data was given in a five year interval. Through interpolation were we able to obtain annual data. We expect a positive relationship between the human capital stock accumulation and economic growth.

Tallman and Wang (1994) point out that the financial system of a country is also known to affect the level of economic growth. He cites Levin and Zervos, 1993 as arguing that economies with more efficient financial systems are able to allocate more efficiently savings to the best investments hence high productivity and growth. Uganda has over couple of years made considerable attempts to develop it financial sector, hence the need in our study to establish whether there is a link between growth in the financial sectors

and economic growth in Uganda. We use M2 as a percentage of GDP to proxy for financial sector activity in Uganda. The data was obtained from World Development Indicators (2004).

Tallman and Wang (1994) also point out political instability as also impacting on economic growth. It is believed that countries that experience more revolutions and coup de tats grow more slowly than stable countries Levin and Zervos, 1993 as in Tallman and Wang (1994). Gallup et al (1998) also find a strong negative relationship between political instability and economic growth. In our Uganda case study we attempt to capture the effects of political instability through a dummy variable spanning the period 1971 – 1980. We use it as an exogenous series that tries to capture the changes in the economy that could have resulted from policies of Idi Amin Dada.

Government policies such as openness to the global economy also affect economic growth. Gallup et al (1998) as in Tallman and Wang (1994), conclude that open economies are in better position to import new technologies and ideas from the rest of the world. In our study we also note over a period of time Uganda has adopted open policies and many other major economic reforms. As a result we examine the effect of openness to economic growth in Uganda. We capture the effect of openness using the trade variable of imports plus exports as a percentage of real GDP per capita which is the total trade as a percentage of GDP. We obtain the data for this variable from the Penn world tables (2004).

Theory postulates that physical capital investment is critical for any growth process. We therefore find it critical to have it factored in our empirical analysis. Physical capital variable is captured by gross fixed capital formation (GFCF). The transformed data was obtained from the data set used by Musila and Belassi (2004) and additional data for the period (1962 – 1965 and 2000- 2002) was obtained from Uganda Bureau of statistics (UBOS) statistical abstracts (1960 – 1965) and the World Development Indicators (2004).

The Labour input variable (the total labour force) is theoretically a very critical factor in economic growth and is included in our empirical analysis. The employment data was also obtained from the Musila and Belassi (2004) data set and the additional for years

(1962 – 1964 and 2000 – 2002 was obtained from the Uganda Bureau of Statistics (UBOS) statistical abstracts (1960 – 1965 and 2002-2004).

Education expenditures as percentage of GDP variable though not part of the estimation equation is used for other simple tests to show the link between education expenditure and human capital accumulation (average years of schooling and average education expenditure per worker that are used as proxies for human capital) using simple correlations and scatter plots see annex 2. The data for the variable was obtained from various statistical abstracts of Uganda Bureau of Statistics (1960 – 2004); and Uganda background to Budget issues (1976 – 1988).

One dummy variable is included in the model. Dummy 1 (1 = period 1971 – 1980 and 0 elsewhere) as an exogenous series intended to capture structural shifts in the economy as a result of the policies of military regime of General Idi Amin.

The final variable used the Real GDP (total output) like in most of the growth studies stands out as the dependent variable. The data was obtained from the UBOS various statistical abstracts and the Musila and Belassi (2004) data set.

4.6 Estimation of the Model and Interpretation of the Results

4.6.1 Estimation Method and Procedure

Time series data is one of the common types of data used in empirical analysis. However, as put forward by Gujarati (2003 pp 792), use of time series data poses a lot of challenges to empirical analysis. According to Gujarati (2003) empirical work based on time series data assumes that the underlying time series is stationary, which often is not the case. A non stationary series according to Gujarati (2003, ppp798), is a situation whereby the information about the macroeconomic variable under investigation will be useful only for that time period and any prediction will not be of any practical value. It is therefore vital to take this into consideration since estimating a regression model with non stationary variables with the usual Ordinary Least Squares (OLS) techniques of regression analysis may give biased estimates and may lead to misleading conclusions (Stock and Watson, 1988) as in Amankwah (2004). That is the marginal significance levels of standard software packages for T and F tests would not be valid but make us accept the spurious

regression relationships (Amankwah, 2004). An important consideration therefore in estimating the regression model as specified above by the OLS is to test for stationarity of the included macroeconomic variables. That is, the mean, variance and auto – covariance (at various lags) of the set of the macroeconomic time series should remain the same no matter at what point we measure them. If this is to be the case, a particular time series will tend to return to its mean (mean reversion) and its variance will generally have a constant amplitude (Gujarati, 2003).

Non – stationary time's series is categorised into two as a guide for determining the transformation method to be used in making them stationary[16]. These are;

1. Processes which consist of a deterministic function of time (deterministic trend) and stochastic stationary process (trend stationary)
2. Time series whose first or higher difference is stationary (difference stationary)

One of the ways of dealing with the problem of non stationary series is to use the first difference of each variable for the regression model. It is known that differencing normally results into stationarity of the variables. However, Amankwah (2004) also notes that differencing creates its own problems since "all information about potential long run relationships between the levels of economic variables is lost" (Hendry, 1986, pp201). Mukherjee et al (1998) recommends the test for cointegration of the set of the variables as alternative solution. Cointegration analysis provides a way to conduct econometric analysis of non stationary variables. Since this particular study uses time series data that is historic in nature, we find it plausible to conduct tests for unit root and cointegration.

4.6.2 Stationarity, Cointegration, OLS regression and Error Correction Model

In this paper we use unit root test for stationarity, Engel – Granger test for cointegration and then later estimate the long run and short run models to determine the relation between human capital and economic growth.

4.6.2.1 Test for Stationarity Using the Augmented Dickey-Fuller Method

Before we test for unit root and cointegration, we can draw a graph for each variable plotted against time to get first impressions about the data stationarity. We note that the graphs (7a to 7g, see annex 4) indicate that most of the variables show a high level of

[16] see Gujarati (2003) and Mukherjee et al (1998)

fluctuation over time. They do not show a stable trend, this gives the impression that they are likely to be non-stationary.

The test for unit root for the time series for our variables was done using the Augmented Dickey-Fuller (ADF) test (refer to Annex E - 1 for details of the procedure). We are testing the null hypothesis that there is unit root (or the series is non stationary). We use Stata 8 software. The results of the Augmented Dickey-Fuller test for unit root are summarized in table 4.

Table 4: Augmented Dickey – Fuller test for Unit root (1962 – 2002)

Variables	No of lags	Without trend	With trend	No of lags	1st Diff without trend	1st Diff with trend	Conclusion
logrgdp	0	1.467	-1.235	0	-5.267***	-5.652***	I(1)
logk	0	-0.469	-1.464	0	-6.888***	-6.979***	I(1)
logl	0	-1.529	-2.641	0	-4.611***	-4.515***	I(1)
logavsch	0	1.428	-2.430	1	-2.555	-2.659*	I(1)
logm2gdp	0	-0.791	-1.381	0	-3.916**	-3.876**	I(1)
logopen	0	-2.195	-2.030	0	-6.107***	-6.173***	I(1)
logeducgdp	0	-2.986	2.934	0	-8.542***	-8.462***	I(1)

Notes: *stationary at 10% significance level, ** stationary at only 5% and 10% significance levels and *** indicates significance at all levels of significance of 1%, 5% and 10% respectively.

4.6.2.2 Augmented Dickey Fuller Results for Unit root

From table 4 above we observe that the computed t-statistics (with and without trends) refer to columns 1 and 2, are less than the critical values. In this case we accept the null Hypothesis that the series is non stationary for all the variables at levels. Tests for each of all the variables based on first differences with and without time trend leads to the conclusion that all the variables LOGRGDP (real GDP), LOGK (Physical capital), LOGL (labour input), LOGM2GDP (financial sector development), LOGEDUCGDP (education expenditure as percentage of GDP) and LOGOPEN (government policy of openness) have no unit roots at 10% level of significance as shown in columns three and four. The variable LOGAVSCH (average years of schooling) had no unit root only with a time trend at lag one at 10% level of significance refer to column four. Our conclusion is that our variables are integrated in the order of 1(1)

Using the Breusch-Godfrey LM test for autocorrelation without trends, the computed chi-square is less than the critical chi-square at 10%, 5% and 1% significance levels and 1 degree of freedom. Thus, the null hypothesis of no serial correlation can be accepted.

However, the test of autocorrelation by including trends show existence of autocorrelation. The problem of autocorrelation in this case is unavoidable even if we include lags until we run out of observations. This can be due to the fact that economic time series could be trend stationary or difference stationary. Accordingly, including time or trend variable in a regression model to 'detrend' the data is justified only for trend stationary time series (Gujarti, 2003). Consequently, including time trend for difference stationary results with variable or stochastic trend, as in the case of the results depicted in Table 4, is inappropriate.

4.6.2.3 Engel and Granger Cointegration Test

After testing for stationarity of our series, we therefore test for cointegration of the variables in our model to see whether there exists an equilibrium relationship between the variables (see Annex E – 2 for details of the procedures). Regression of one time series variable on one or more time series variable often can give spurious results (Wooldridge, 2003). One way of controlling this problem is by testing if the time series are cointegrated. If a group of variables are individually integrated of order one, their linear combination might be stationary. In this case the time series are said to be cointegrated and suggests the existence of long-run or equilibrium relationship between them.

On the other hand if the time series are non-stationary, it is not possible to generalize for other periods. The series can be used only to study the behaviour of the time period under consideration. For this reason, the knowledge that some variables are cointegrated can have a significant impact on the analysis of the short and long run dynamics of the economic variables. Three general approaches are widely used for testing whether non-stationary economic time series are cointegrated. These are: Vector auto regressions formulated by Johansen (1988, 91, & 95), single equation static regression due to Engle and Granger (1987), and single equation error correction model (Thomas, 1999). And as shown in the table 4 above that all our variables are non stationary and integrated in the order of 1(1), we used Engel and Granger test for cointegration where we estimated an OLS regression, obtained the residuals and used the ADF tests for cointegration. In the Engle-Granger procedure the notion of cointegration applies when two series are I (1), but a linear combination of them is I (0); in this case, the regression of one on the other is not spurious, but instead tells us something about the long-run relationship between them. Cointegration between two series also implies an error correction model for the short-

term dynamics. The idea is that individually some of the variables are integrated of I(1), thus regressing non-stationary variable on another non-stationary variable might yield spurious results. Thus, test for cointegration is indispensable. The Engle-Granger methodology seeks to determine whether the residuals of the equilibrium relationship are stationary However, as cautioned by Gujarati (2003 pp 823) that since the estimated e_t are based on the estimated cointegrating parameter β_2, the ADF critical significance values are not quite appropriate for the tests. We therefore used the Mackinnon computed critical values[17] and the cointegration results are shown tables 6a and b, 7a and b.

Table 5: Long run regression equation

Source	SS	df	MS	Number of obs = 41 F(7, 33) = 225.94 Prob > F = 0.0000 R-squared = 0.9755 Adj R-squared = 0.9712 Root MSE =.06115	
Model	5.07001554	6	.845002591		
Residual	.12715706	34	.003739914		
Total	5.1971726	40	.129929315		
logrgdp	**Coef.**	**Std. Err**	**t**	**P>t**	**95% Conf. Interval**
logk	.2930391	.033326	8.79	0.000	.2253125 .3607657
logl	.9054243	.1516874	5.97	0.000	.5971585 1.21369
logavsch	.3784488	.081112	4.67	0.000	.2136094 .5432883
logopen	.052527	.1308292	0.40	0.691	-.2133499 .318404
logm2gdp	-.1355058	.0337383	-4.02	0.000	-.2040703 -.0669414
dummy1	-.0068583	.0376469	-0.18	0.857	-.083366 .0696494
_cons	-2.561112	1.367855	-1.87	0.070	-5.340928 .2187039

Source: Own computation from Stata 8 soft ware

After running the above OLS regression we performed a unit root on the residuals obtained from the above regression and obtained the following results using the Stata 8 soft ware.

4.6.2.3.1 Test for Cointegration with time trend, at lag 0

Table 6a: Dickey-Fuller Test for Unit Root

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.072	-4.242	-3.540	-3.204
* MacKinnon approximate p-value for Z(t) = 0.0097				

Source: Own computation from Stata 8 soft ware

[17] Available in R.F Engel and C.W .J Granger in their book "Long run economic relationships; Readings in Cointegration; Advanced texts in Econometrics, Chapter 13 Critical values for cointegration tests

As earlier on stated the critical values taken from Davidson and Mackinnon are summarised below;

Table 6b: Asymptotic Critical Values for cointegration test with trend

Significance level	1%	5%	10%
Critical value	-4.32	-3.78	-3.50

Source: Davidson and Mackinnon, 1993

4.6.2.3.2 Test for Cointegration without time trend at lag 0

Table 7a: Dickey-Fuller Test for Unit Root

	Test Statistic	1% Critical Value	5% Critical Value	10% Critical Value
Z(t)	-4.126	-3.648	-2.958	-2.612
* MacKinnon approximate p-value for Z(t) = 0.0013				

Source: Own computation from Stata 8 soft ware

Table 7b: Asymptotic Critical Values for cointegration test without trend

Significance level	1%	5%	10%
Critical value	-3.90	-3.34	-3.04

Source: Davidson and Mackinnon, 1993

From tables 6a and b, and 7a and b, the absolute values of the test statistics (4.072) table 6a and (4.126) table 7a are greater than the Engle-Granger 5% and 10% absolute critical t-value (3.78 and 3.50) table 6b and (3.34 and 3.04) table 7b. Accordingly, it can be concluded that the residuals from the regression are stationary. Similarly, the computed chi2 for autocorrelation 0.9215 is less than the critical chi2 value at 10%, 5% and 1% level of significance. Thus, the null hypothesis that there is no serial correlation can be accepted. The conclusion is that the residual is stationary. This implies the existence of long-run or equilibrium relationship between the variables. By the same token, even though the time series variables are individually non-stationary, they are cointegrated and the regression is not spurious- it is meaningful to regress real GDP on the rest of the explanatory variables LOGK, LOGL, LOGAVSCH, LOGM2GDP and LOGOPEN. The reason is that the linear combination cancels out the stochastic trends in the time series variables (Gujarati, 2003). Including time trend in the unit root test is subject to autocorrelation due to the reasons explained above.

4.7 Long Run Estimates and Discussion of regression

The estimates of the long run relationship table 5 above shows that LOGK (physical capital), LOGL (labour input), LOGAVSCH (average years of schooling), and LOGOPEN (openness) have a positive effect on real GDP. Specifically, increase in physical capital by 1% leads to 0.29% increase in real GDP. An increase in labour input by 1% also results in 0.9% increase in real GDP. Like wise a 1% increase in average years of schooling yields a 0.38% increase in real GDP. The regression result is highly statistically significant. Further a 1% increase in openness leads to 0.05% increase in real GDP however, it is statistically insignificant. However on the other hand LOGM2GDP which is a proxy of financial sector development is negative contrary to the expected sign. A 1% increase in financial sector development leads to 0.1% decrease in real GDP. The dummy variable had a negative sign implying that Amin era had a negative effect on real GDP growth although it was statistically insignificant.

4.8 Error Correction Model

The Engle-Granger test have showed that the variables LOGRGDP, LOGK, LOGL, LOGM2, LOGOPEN and LOGAVSCH are cointegrated, which means there is a long run or equilibrium relationship between these variables. It is therefore possible to run a regression that involves first differences and lags and get results that represent the difference of the dependent and explanatory variables. This does not mean that in the short run they may not be disequilibrium. The error correction model corrects for this disequilibrium. Granger representation theorem (Gujarati, 2003 pp 825) states that if two variables are cointegrated, then the relationship between the two variables can be expressed as error correction mechanism (ECM)

We estimated a linear OLS regression using differences of the explanatory variables, dependent variable as well as the lag of the error correction term/ residual obtained from the long-run regression. Estimates of error correction are presented in Table 8 below;

Table 8: Error Correction Model Estimates

Source	**SS**	**df**	**MS**	Number of obs = 40	
Model	.057083708	7	.008154815	F(8, 31) = 3.91	
Residual	.066751636	32	.002085989	Prob > F = 0.0035	
Total	.123835344	39	.003175265	R-squared = 0.4610	
				Adj R-squared = 0.3431	
				Root MSE = .04567	
Dlogrgdp	**Coef.**	**Std. Err**	**t**	**P>t**	**95% Conf. Interval**
Dlogk	.1229355	.0367499	3.35	0.002	.0480784 .1977927
Dlogl	.5245544	.2719102	1.93	0.063	-.0293085 1.078417

Dlogavsch	.2117372	.1296453	1.63	0.012	-.0523418 .4758161
Dlogopen	.0221656	.0979171	-0.23	0.822	-.2216163 .1772851
Dlogm2gdp	-.1338658	.0566502	-2.36	0.024	-.2492585 -.0184731
Ddummy1	-.0003511	.0334757	-0.01	0.992	-.0685388 .0678367
ECML1	**-.3859205**	**.1575991**	**-2.45**	**0.020**	**-.7069395 -.0649016**
_cons	.0212391	.0126193	1.68	0.102	-.0044656 .0469438

Source: Own computation from Stata 8 soft ware

4.8.1 Short Run estimates of the regression

From Table 8 above the effects of LOGK (physical capital), LOGL (labour input), LOGAVSCH (average years of schooling), and LOGOPEN (openness) on real GDP are still positive and statistically significant. We observe that a 1% increase in physical capital leads to 0.12% increase in real GDP, likewise a 1% increase in the labour input generates a 0.5% increase in real GDP. Equally a 1% increase in average years of schooling generates a 0.2% increase in real GDP. A 1% increase in openness generates a 0.02% increase in real GDP though statistically insignificant. Again like in the long run the financial development is negatively signed and statically significant. A 1% increase financial sector development generates 0.1% decrease in the real GDP. The dummy is negatively signed indicating negative effects of the Amin regime in the real GDP but statistically insignificant. The error correction term in Table 8 above is highly significant. The speed of adjustment of the error correction term of -0.39 implies that the system corrects its previous period level of disequilibrium by 39 % within a year. Equally, 39% of previous year's real GDP disequilibrium from the long run will be corrected each year.

4.9 Diagnostic Tests

Three diagnostic tests are made based on the assumptions of the classical normal linear regressions given in Gujarati (2003:65-81).

The data was found to be homoscedastic at 10% level of significance because the computed Chi-square of 4.84 is less than the critical chi-square (6.63) at 1 degree of freedom. The data also passed the normality test. Likewise there was no serial correlation as the computed chi-square of 5.665 is less than the critical chi-square (6.63) at 1 degree of freedom at 10 % level of significance. The error correction estimation given table 8 also passes all the diagnostic tests with Chi-square of 0.19 less than critical chi-square 3.84 at 1 degree of freedom indicating that the data was homoscedastic at 5% level of significance. Like wise no serial correlation was detected because computed chi-square of

0.168 is less than the critical chi-square (3.84) at 1 degree of freedom at 5 % level of significance.

4.10: Overall Conclusion

From both the SR model and the long run regression analysis we find a statistically significant effect of human capital as measured by average years of schooling on economic growth. We find that in the short run a one per cent increase in average years of schooling leads to a 0.2 % increase in the real GDP like wise in the long run, a 1% increase in the average years of schooling leads to 0.38% increase in the real GDP. Our findings are in line with other studies on this relationship such as Belassi and Musila (2004), Barro (1991), Gemmel (1996) and many others who all found a positive relationship between human capital and economic growth. It however differs from other studies such as those by Benhabib and Spigiel (1994), Devarajan et al (1996) and Levine and Renelt (1992) among others who found either weak or negative relationship between human capital and growth.

CHAPTER FIVE: SUMMARY, CONCLUSIONS AND POLICY IMPLICATIONS

5.0 Summary and Conclusion

This study set out to estimate the effects of changes in education expenditure on human capital accumulation and human capital and economic growth using time series data (1962 – 2002) using descriptive statistics, Cointegration technique and Error Correction Model.

Our study finds a very strong association of 0.69 (69%) between education expenditure and average years of schooling see graph 5a in Annex B implying that education expenditures are positively correlated with human capital stock. And based on our econometric analysis we also found out that average years of schooling have a positive and significant relationship with real GDP. The results indicate that human capital stock proxied by average years of schooling is positively correlated to increase in real GDP in Uganda. We conclude that a one percent increase in the average years of schooling, ceteris paribus would lead to 0.36% increase in real GDP in the long run and 0.27% increase in real GDP in the short run.

Other factors also such as investment in physical capital, labour input, and openness contribute to increase in real GDP in Uganda.

The study therefore accepts the alternative hypothesis that there is a positive relationship between in education expenditure and human capital stock proxied by average years of schooling and human capital stock with economic growth (real GDP) as shown by the preceding summary of the results.

5.2 Policy Recommendations

The government of Uganda's long term commitment to human capital stock accumulation is worthwhile. The government policy of universal primary education, prioritisation of resources to education and health sectors are therefore worthwhile endeavours. We therefore recommend the following policy recommendations for sustained rewards from investment in education.

The government should continue commit resources to education sector and expand access to education sector. Issues around quality of education and delivery should also be taken into account and this can be achieved through to pursuit of the policy of openness so that

it can be able catch up with the challenges of globalisation in terms of technology and new ideas. Continued investment is also critical for Uganda's growth; therefore implementation of sound macroeconomic policies currently in place should continue to be maintained. This is also a basis of Foreign Direct Investment (FDI) which also depends on openness and sound policy environment. Private investment and increased role of the private sector in education should be promoted further since it has contributed largely to expansion in education attainment in Uganda.

ANNEXES

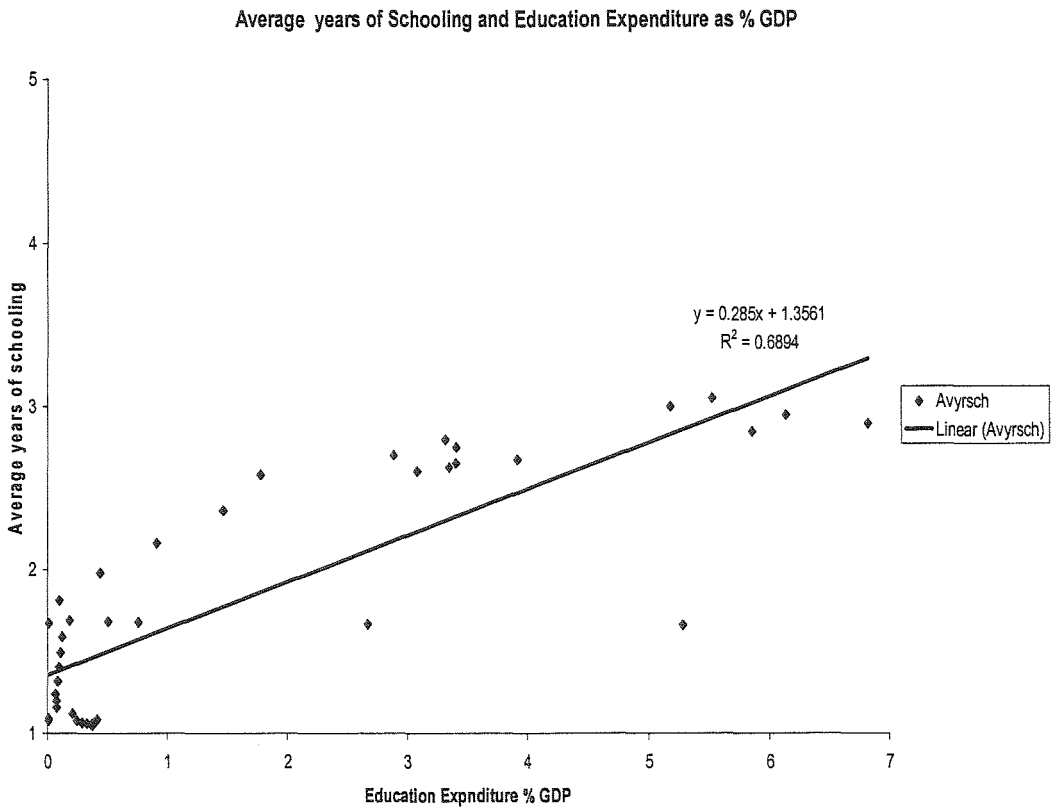
Annex A: Summary statistics

Table 9: Summary Statistics for period 1962 – 2002

Variable	Observations	Mean	Standard Deviation	Minimum	Maximum
logrgdp	41	7.909162	.3604571	7.419467	8.665212
logk	41	5.708983	.6232841	4.695497	6.79263
logl	41	8.731873	.2184558	8.305261	9.104489
loge	41	-5.039881	.4048316	-5.957195	-4.427975
logavsch	41	1.846795	.7185862	1.05	3.05
logopen	41	1.522336	.121467	1.23045	1.72428
Logm2gdp	41	-.8405068	1.960318	-3.6772	1.91073
logeducgdp	41	-.2680446	.8017724	-1.9556	.8330723
dummy1	41	.2195122	.4190582	0	1

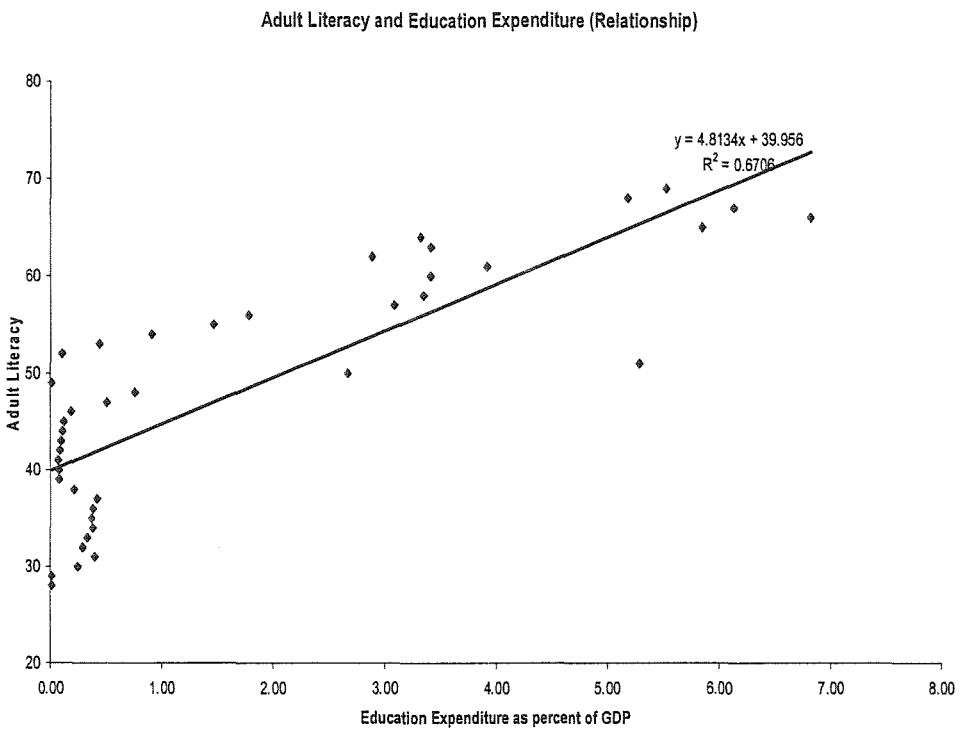
Annex B: Graphical relationship between education expenditures and human capital

Figure 5a: Education expenditures as percentage of GDP and average years of schooling



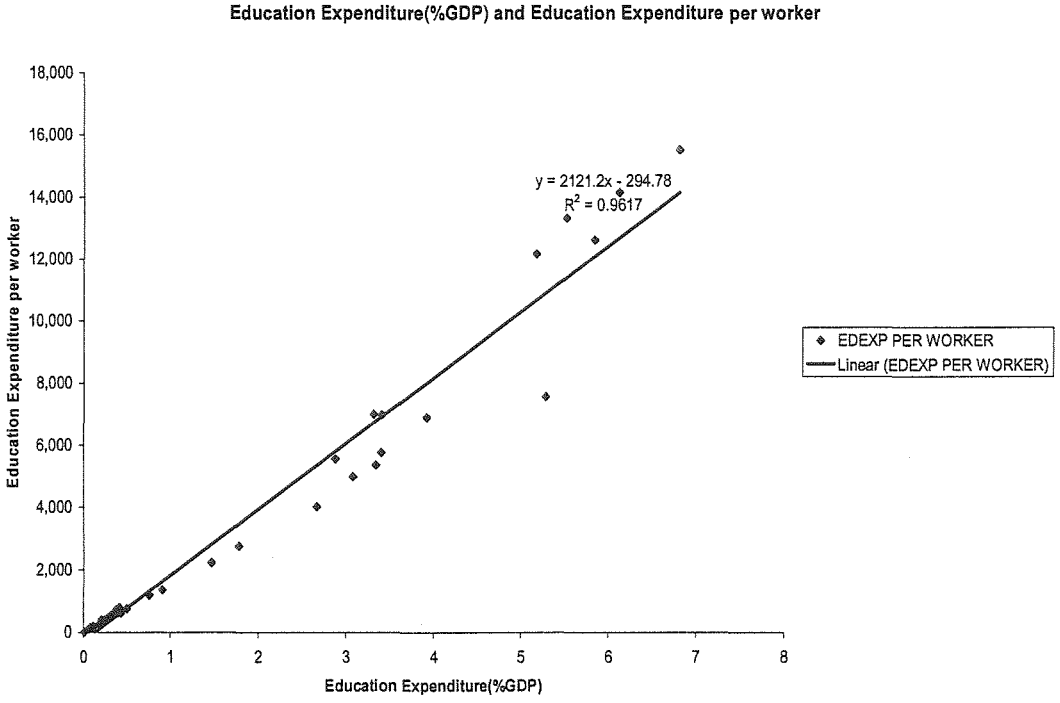
Source: Authors own computation from various sources

Figure 5b: Education expenditures as percentage of GDP and adult literacy in Uganda



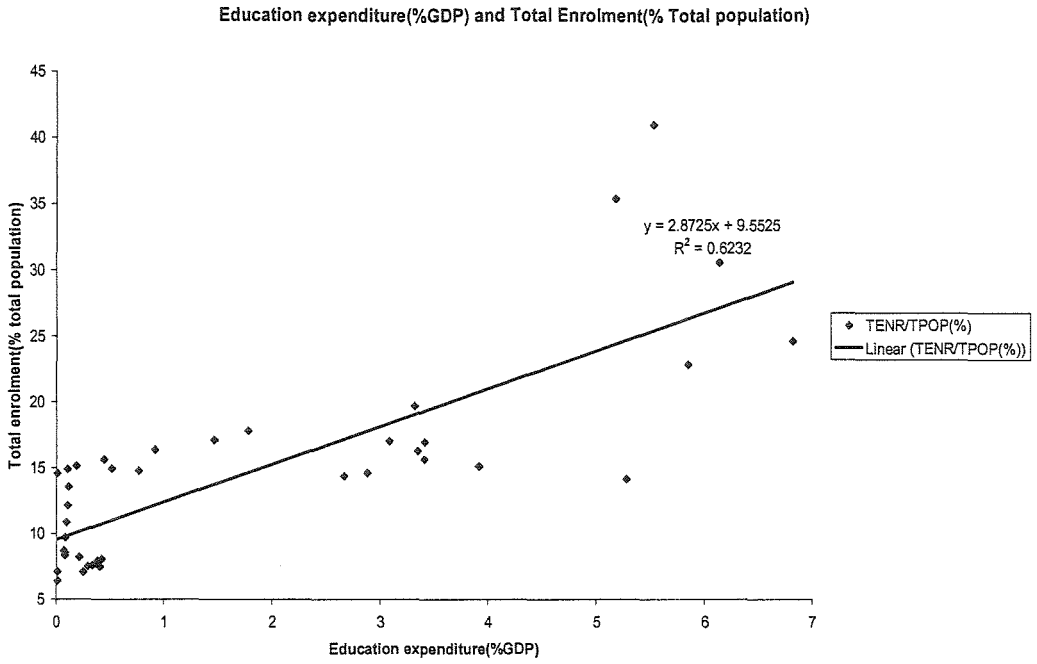
Source: Authors own computation from various sources

Figure 5c: Education expenditures as percentage of GDP and education expenditure per worker



Source: Authors own computation from various sources

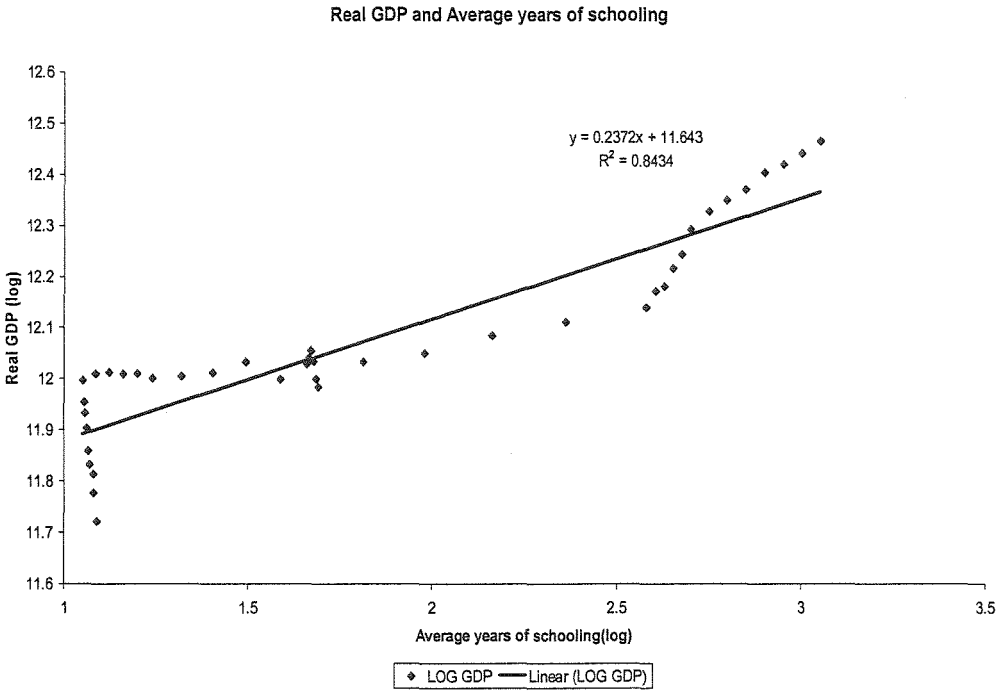
Figure 5d: Education expenditures as percentage of GDP and total enrolment in Uganda



Source: Authors own computation from various sources

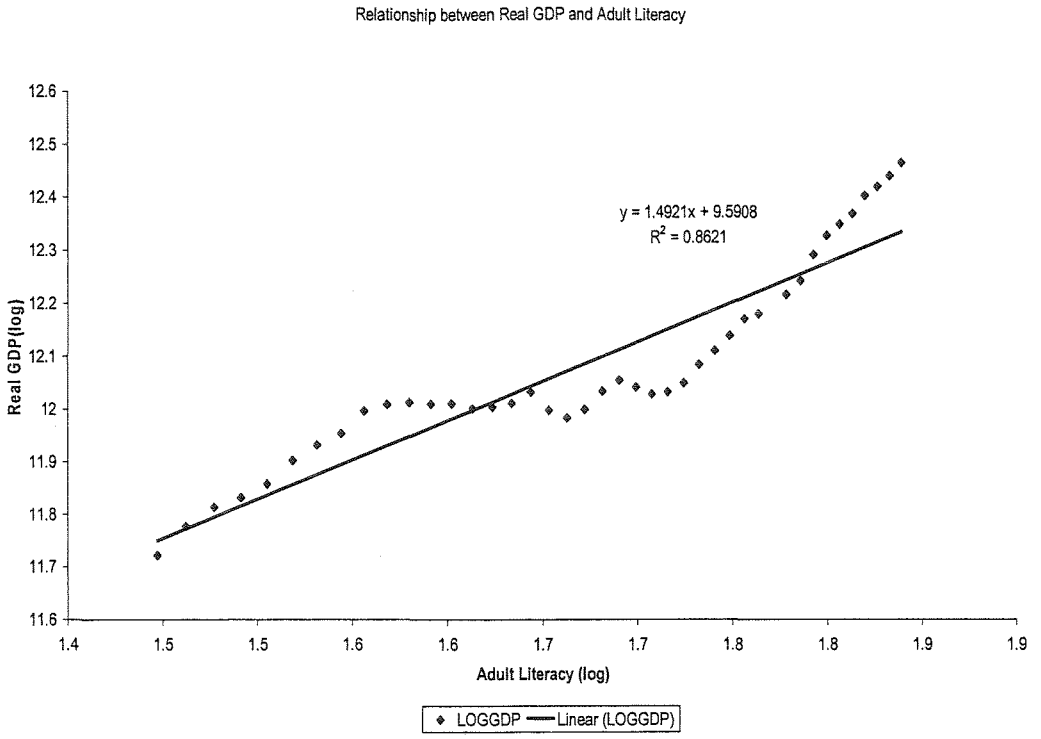
Annex C: Graphical relationship between human capital and Real GDP

Figure 6a: Average years of schooling and economic growth in Uganda



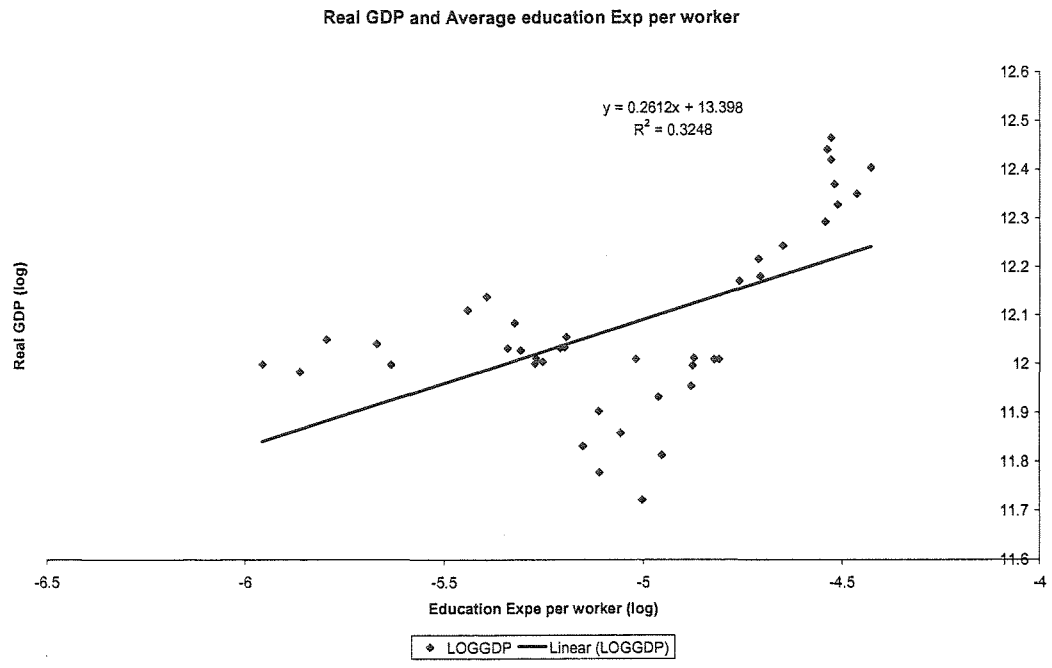
Source: Authors own computation from various sources

Figure 6b: Adult literacy and economic growth in Uganda



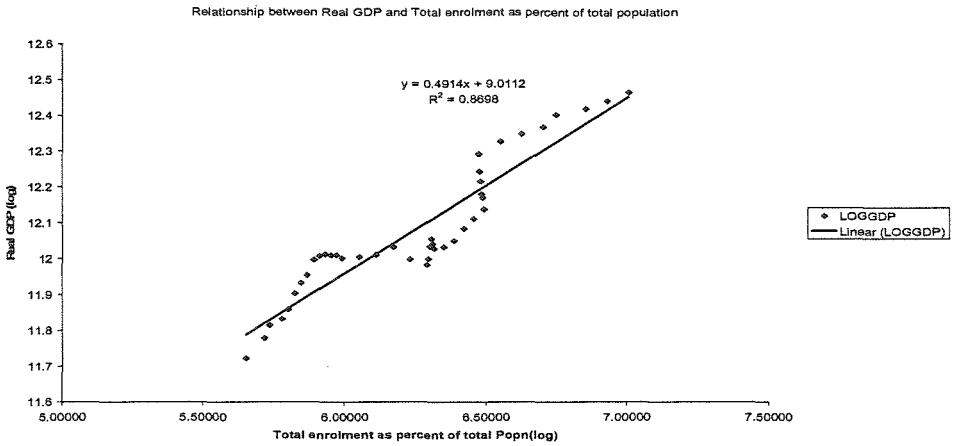
Source: Authors own computation from various sources

Figure 6c: Education expenditure per worker and economic growth in Uganda



Source: Authors own computation from various sources

Figure 6d: Total enrolment as percent of total population and economic growth in Uganda



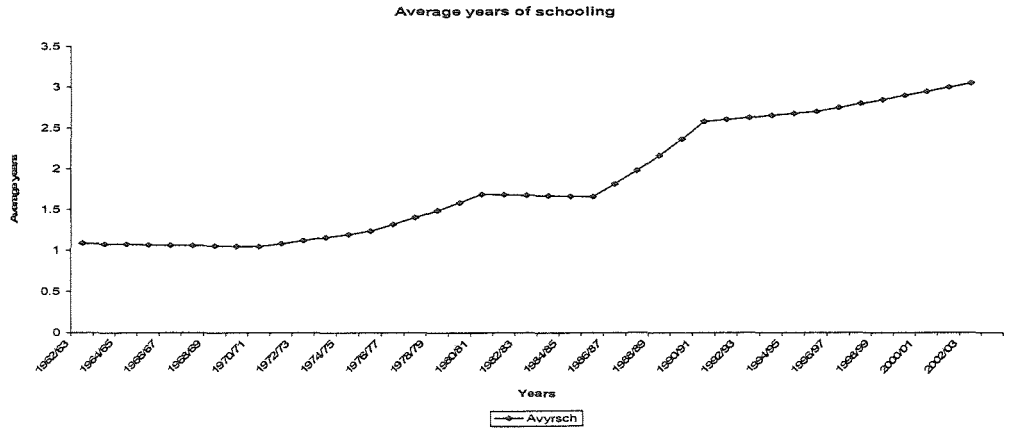
Source: Authors own computation from various sources

Annex D: Graphical test for stationarity of the time series for Uganda

Graph7a: Real GDP (1962 – 2002) in Uganda

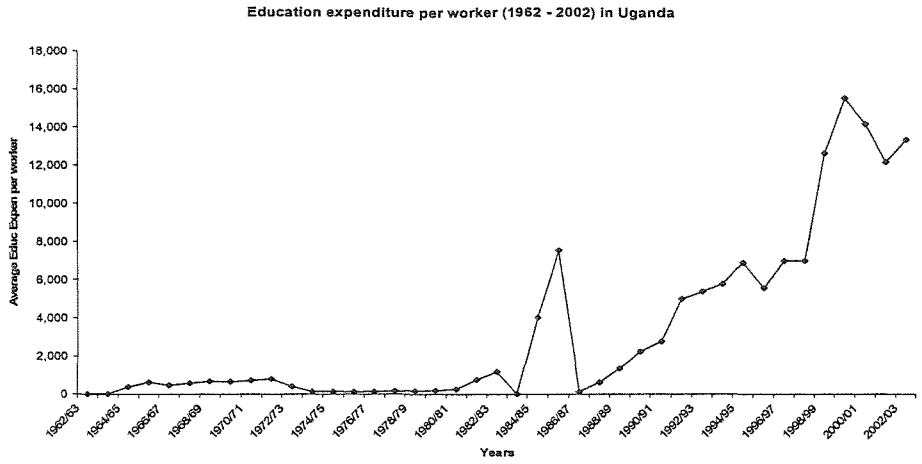
Source: Authors own computation from various sources

Graph 7b: average years of schooling (1962 – 2002)



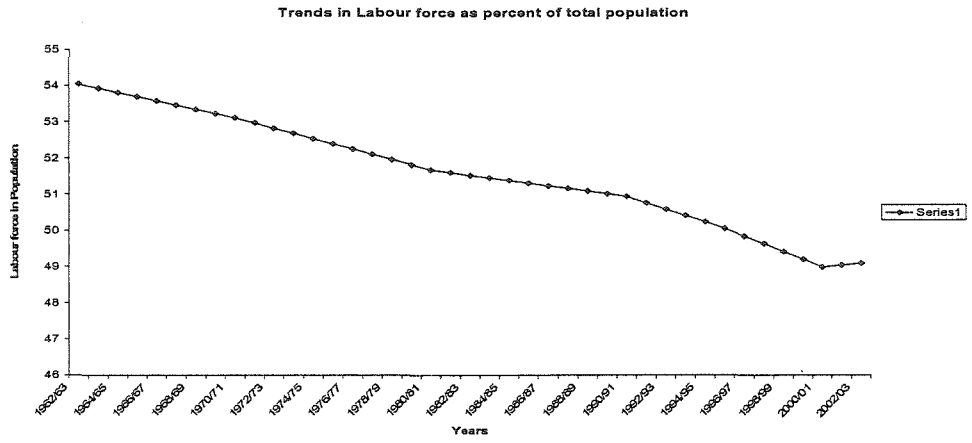
Source: Authors own computation from various sources

Graph 7c: Average education expenditure per worker



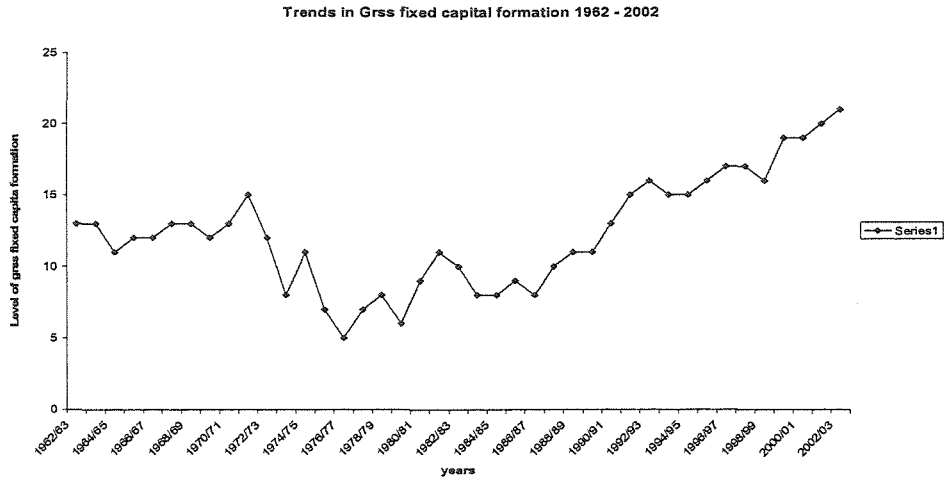
Source: Authors own computation from various sources

Graph 7d: Labour force as percent of total population



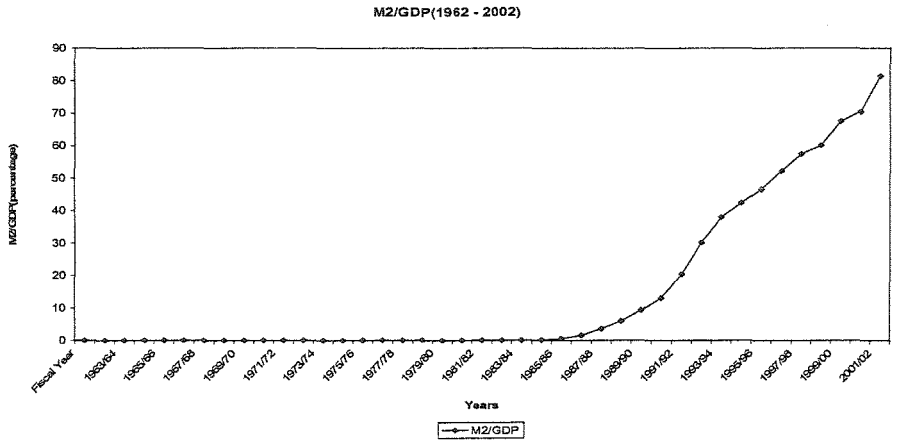
Source: Authors own computation from various sources

Graph 7e: Gross fixed capital formation as percentage of GDP



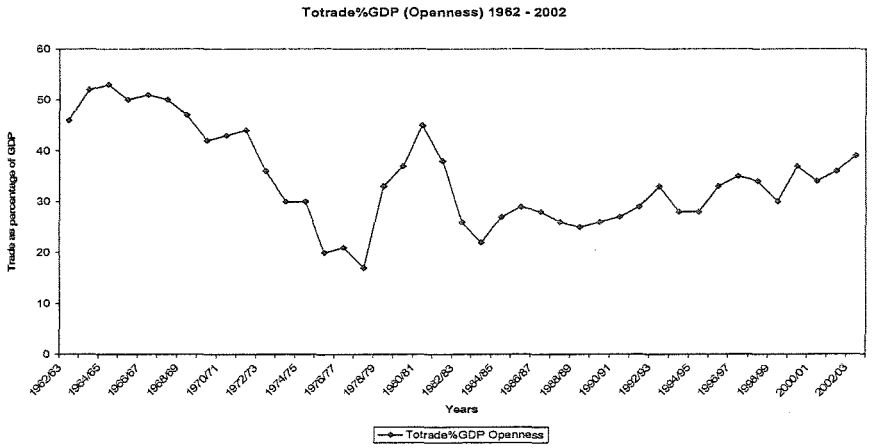
Source: Authors own computation from various sources

Graph 7f: M2 as percentage of GDP (1962 – 2002)



Source: Authors own computation from various sources

Graph 7g: Trade as percentage of GDP (1962 – 2002)



Source: Authors own computation from various sources

Annex E – 1: Stationarity Tests

Gujarati (2003) presents three methods of stationarity tests namely; graphical analysis, correlogram test and unit root test. Our study will apply graphical and unit root test methods.

Graphical analysis method is meant to give a bird's eye view of the nature of the time series data under study. Gujarati (2003) advises that before performing formal tests, plotting the time series gives an initial clue whether the data is stationary or not. This is because we may find high correlation coefficient (and high R^2) and tend to conclude that there is a causal relationship between the two variables. However, it is possible that two variables trending consistently, say, upwards could be spuriously correlated and two

other variables trending in different directions could be truly and strongly correlated. Thomas, (1990), notes that classical regression techniques applied to trending stochastic time series variables with spurious correlations are likely to be invalid. Such techniques are primarily designed to untrending or stationary, variables whose mean, variance and covariance remain constant over time. On the other hand, a trending variable has mean and variance that change over time (Thomas, 1990). Thus, before applying an ordinary OLS regression, we have to test if the variables are stationary or non- stationary, also known as testing for unit root.

Unit root test is the most widely used formal test for stationarity or non stationarity of time series. A number of techniques have been prescribed to check for stationarity or unit root such as the Phillips – Perron (PP) test, Perron – Break (PB) test, Dickey Fuller (DF) test, and Augmented Dick Fuller (ADF) test. Our study uses the Augmented Dick Fuller (ADF) test to test for the stationarity of our variables.

Annex E – 2: Testing For Co-Integration

We can estimate the equilibrium relationship between two variables Y_t and X_t using the Error Correction Model (ECM). However, the estimation of the ECM is based on the idea that there exists an equilibrium relationship between the variables relevant to the model (Gujarati, 2003). Thus, before we estimate the ECM, we need to test for the existence of such equilibrium relationship. This is called the test for cointegration. A series is said to be integrated of order d if it has to be differenced d times before it becomes stationary. Two time series are called cointegrated of order d,b denoted as CI(d,b) if the following two conditions are satisfied. First both must be integrated of order d. Second, there should exist a linear combination of both which is integrated of order $b < d$. A set of variables are said to be cointegrated if there exists some linear combination between them which is in the order of I(0) using the OLS regression. In other words, the test for cointegration involves testing whether the residuals from an OLS regression between the set of variables are stationary. If the residuals are stationary then the series are said to be cointegrated. The levels of regression will then provide consistent estimates of the long run relationship (Mukherjee (1998). We obtain our order of integration of our time series by applying the Engel – Granger test for cointegration using Stata 8 soft ware.

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