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Relationship between Investment in Human Capital and Economic Growth Evidence from Mozambique

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Abstract: *This study investigates the long run relationship between human capital and economic growth in Mozambique over the period 1975 to 2006 through the application of Engle-Granger Two Step Error Correction Methodology. Human capital is measured as gross enrolment. Human capital is considered as a direct input in the production function. The Engle-Granger Cointegration results establish a long run relationship between human capital and economic growth. A well educated labour force appears to significantly influence economic growth as a factor in the production function. Thus, government's educational policy should focus on promoting education at all levels.*

I. Introduction

Human capital is a key factor to a country's economic growth (Lucas, 1988, Romer 1990). Elias and Fernandez (2000) assert that a major source of sustained growth in per capita income is the accumulation of knowledge and its subsequent embodiment in either society's physical or human capital. Human capital means knowledge or skills embodied in human beings. Elias and Fernandez (2000) further argue that there are many channels through which knowledge is acquired: formal schooling, primary research, on-the-job training, learning-by-doing, and product innovations (both vertical and horizontal), among others.

According to the Endogenous growth models of the 1970s and 1980s popularized by Romer (1986), Lucas (1988) and Barro (1991), educational development is a good way of generating economic growth. In addition, policy measures such as subsidies on research and development or increasing the incentive to innovate, can have an impact on the long-run growth rate of an economy (Lucas, 1988, Romer 1990, Mankiw, 1992). Entrepreneurship and strength of institutions are also important factors in the endogenous growth theories. Thus, investment in human capital is an important vehicle of achieving equitable income distribution, a potent means for addressing the problem of poverty especially in developing countries.

Studies that have modeled human capital in the growth process (Ncube, 1999) have shown that disparities in productivity, per capita incomes and economic development can be explained by the variation in the stock of human capital or investment in human capital. Barro (1991) finds that per capita growth rate is positively related with the level of human capital. This is also supported by the World Bank (1995) which affirms that human capital investments can improve life levels because they enlarge employment opportunities, increase productivity, attract investments and have importance for economic growth and well-being of the families.

People are the most precious natural resources a nation possesses. Several industrialized nations of the World like Switzerland, Japan and others lack land, energy and mineral resources like iron ore or oil. But over the years, they have come to realize that human capital is their most important resource for development. No new or modern productivity improvement scheme can be introduced and used effectively without a well trained and educated work force at all levels of the national economy.

Loening (2002), investigating the impact of human capital on economic growth in Guatemala, found that a better-educated labour force has a positive and significant impact on economic growth.

The government of Mozambique considers education as the key to economic growth. Poverty reduction in Mozambique requires economic growth. Thus, government argues that one key to economic growth is to increase the number of Mozambicans with education in all regions of the country and in fields of high labour market demand (World Bank, 2001). Government reiterated that education is one key factor for absolute poverty reduction and to promote economic growth in the country, as stated in the Strategy for Poverty Reduction in Mozambique (PARPA 2001-2005). Education has since independence been a priority sector of the Mozambican government (MESCT, 2000). Since 1990 the Gross Domestic Product (GDP) and Total Public Expenditure on Education (TEEP) have increased simultaneously (MESCT, 2000). For example, public expenditure on higher education increased from 0.5 % of GDP in 1992 to 0.9% in 1999. Total public expenditure on higher education

as a percentage of total expenditure on education increased substantially from almost 8% in 1992 to 22% in 1999 (World Bank, 2001).

Developments in Mozambique's education system have been analyzed in various studies (for example Government of Mozambique 1976, Chilundo and Berverwijk 2001, Arndt 2003, UNICEF 2006). However, these studies did not focus on the relationship between investment in human capital and economic growth.

Government of Mozambique (1976) carried out a study on education but focused on education policy. Arndt (2003) conducted a study on human capital and economic growth prospects for Mozambique but focused on the impact of HIV on human capital stock. MESCT (2000) carried out a study on the reform of Mozambican Higher Education and financing of the education system. Chilundo and Berverwijk (2001) investigated the reform of Mozambican higher education system. UNICEF (2006) evaluated the education system in Mozambique focusing on Expanded System with Room for Improvement. This study seeks to determine whether there is a relationship between investment in human capital and economic growth and to investigate the impact of human capital on economic growth.

Investment in human capital is a driving force of economic growth (Lucas, 1988, Romer 1990, Barro 1991). Thus, education is regarded as a key to economic growth in Mozambique. Since independence the government pursued policies which increased investment in human capital (PARPA, 2001-2005). The country has also been experiencing economic growth over the years, particularly following the end of the civil war. The World Bank (2005) points out that the average annual GDP and GDP per capita growth rates were 8% and 5.6%, respectively, for the period 1995 to 2002. It is therefore important to establish the relationship between human capital and economic growth and to ascertain the extent to which the investment in education impacts on economic growth in Mozambique. This information is crucial in designing educational policies with the aim of fostering economic growth.

The objective of the study is to (1) determine whether there is a relationship between human capital investment and economic growth and (ii) establish the impact of human capital investment on economic growth. The objective will help us to questions such as:

1. Is there any relationship between human capital investment and economic growth?
2. What is the impact of human capital investment on economic growth?

Mozambique makes an interesting case study because it has developed under three education regimes. First, was the colonial system characterized by racial segregation. Under Portuguese rule, local access to educational opportunities and health facilities was severely limited (MESCT, 2000). Secondly, the civil war took its toll: by the end of the war 60% of primary school network had been destroyed or closed (MESCT, 2000). This was followed by an education explosion of the 1990s after the civil war. As stated before, previous studies (Government of Mozambique 1976, Chilundo and Berverwijk 2001, MESCT 2000, Arndt 2003, UNICEF 2006) did not look at the impact of education on economic growth. It is therefore important to look at how significant is education to economic growth in the context of the growing economy and expansion in education. Mozambique has recorded one of the world's highest economic growth rates (around 8% from 1994-2004), (World Bank, 2005)

The study is also important regarding policy formulation and evaluation of the education system. Knowledge of the impact of human capital investment on economic growth is crucial when evaluating policies that are designed to improve the education system. Given that there is an observed economic growth and expansion in education system in Mozambique, it becomes extremely important to evaluate the relationship between investment in human capital and economic growth. This study will concentrate on tertiary education, on the premise that at tertiary level individuals would have acquired the necessary technological capabilities much needed for economic growth (Barro, 1996).

We hypothesize that investment in human capital has a positive impact on economic growth in Mozambique.

The first chapter of the study focuses on the introduction. Chapter two provides an overview of economic growth and higher education in Mozambique. Thereafter, relevant literatures, both theoretical and empirical are reviewed in Chapter three. Chapter four deals with the aspects of the study's methodology. Estimation technique and data sources are considered in Chapter five. Concluding summary and policy recommendations are discussed in chapter six.

II. An Overview of the Evolution of Economic Growth and Higher Education

This section gives an overview of the higher education system and economic growth in Mozambique. Development of higher education, the political context of Mozambican higher education system, expenditure on higher education and recent developments of higher education in the context of poverty alleviation are highlighted.

Economic Growth

When Mozambique attained its independence from Portugal in 1975, the economy was agriculture-based, with very little industrial development. For more than 17 years, a prolonged civil war raged in the country, home to 20.97 million inhabitants in south-eastern Africa. Two decades of conflict took their toll, leaving Mozambique one of the poorest, most debt-ridden countries in the world, with an average real GDP growth rate of -0.1 for the period 1980 to 1990, (Ardeni, 1999).

Starting in 1987, the country embarked on a massive economic reform and privatization program, considered the most active in Africa, (Ardeni, 1999, Arndt, 2006, World Bank, 2003). The government moved away from a centrally-planned economy to market economy. For example, the country's exchange rate, interest rates and prices are now determined by market forces (Ardeni 1999). Government subsidies and restrictions on imports were removed, import tariffs were simplified and crop marketing was liberalized. The banking sector and various state-owned manufacturing operations were privatized (Ardeni, 1999, World Bank, 2006, SADC, 2005).

The above macroeconomic reforms, coupled with donor assistance and political stability that prevailed in the country after the end of civil war in 1992, ushered the country into an era of economic growth. GDP per capita increased from US$144 in 1992 to about US$260 in 1999 (World Bank, 2003). Annual inflation fell from around 50% between 1995 and 1996 to around 5% between 1998 and 1999. Average annual GDP and GDP per capita growth rates for the period 1995 to 2002 were 8% and 5.6%, respectively (World Bank, 2005). Thus, after the strong negative impact of the war on per capita growth, Mozambique now experiences sustained growth resurgence. For example, Table 2.1 below shows the Gross Domestic Product by Sector from 1995 to 2002, according to the available data.

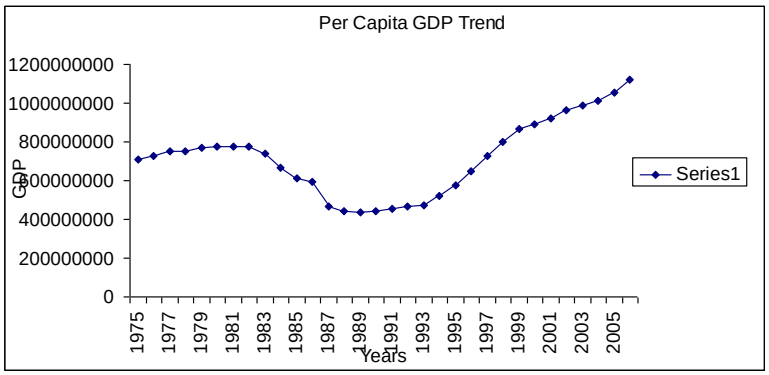
Table 2.1: Gross Domestic Product by Sector (MT bln)

	1995	1996	1997	1998	1999	2000	2001	2002
Agriculture	6,006	9,969	12,011	12,670	13,779	12,346	15,555	16,645
Fishing	985	1,311	1,549	1,595	1,557	1,378	1,601	1,366
Construction	1,272	2,060	2,597	4,118	4,360	5,307	6,170	13,553
Transport/Communication	1,833	2,826	4,381	4,552	4,816	5,297	6,811	9,468
Business	4,707	7,915	9,253	9,738	9,903	11,859	14,960	15,304
Restaurants and Hotels	142	278	491	563	605	5,741	7,584	8,279
Education and Health	396	592	787	1,098	1,384	11,859	14,960	15,304
Other Services	3,455	3,929	4,460	4,957	5,676	3,130	3,494	5,287
Total	**21,277**	**32,719**	**40,554**	**46,427**	**50,827**	**56,917**	**71,135**	**85,206**

Source: Ministerio do Plano e Financas and IMF, Republic of Mozambique, Statistical Appendix, 2003

Growth rates increased in the 1990s and peaked in 1998 and 2001 at about 10%. Figure 2.1 below shows the trend of per capita GDP from 1975 to 2006.

Figure 2:1 Per Capita GDP

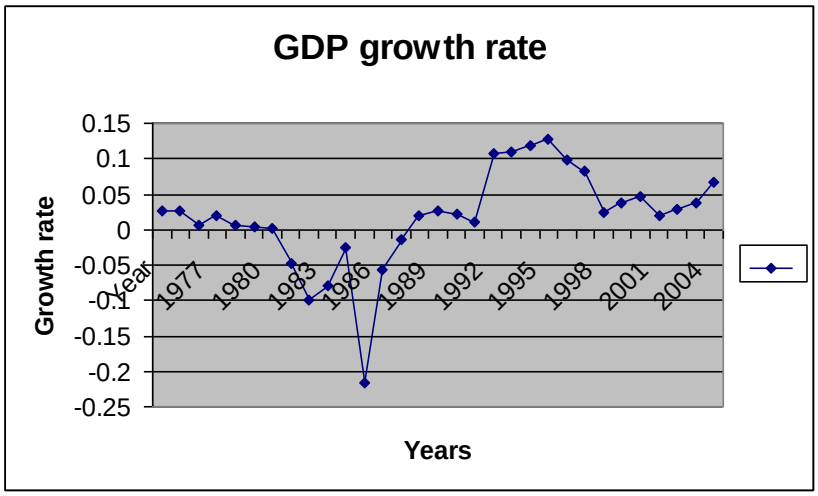


Source: Author's Calculations

The government's economic program is designed to reduce absolute poverty by 30% by 2020, which implies a decline in the poverty head count to less than 50% by the end of the decade. According to Government estimates, this goal can only be achieved if per capita income grows by at least 5% per year over the next ten years. Hence, this requires a GDP growth rate in the neighbourhood of 8% per year or more. The World Bank (1997) recorded that Mozambique is one of the 25 fasted-growing countries for the period 1900 – 1995. For instance, in 1998 the World Bank reported a growth rate of 12%. The recent IMF Policy Framework Paper (PFP) for Mozambique states that "during 1996-98, the economy grew at an annual average rate of 10 percent" (Ardeni 1999). This indicates that the government of Mozambique has put in place policies that have put the country on a growth path in order to achieve its goal, of absolute poverty reduction.

Nevertheless, it is important to state that though there are several sources that point out to the recent growth of Mozambican economy, there is no consensus on the actual evaluation of such growth. The IMF's PFP for 1999-2002 states that, "during 1996-89 the economy grew at an annual average rate of 10 %"(IMF, 1999). The PFP reported an annual change in real Gross Domestic Product (DGP) of 11.3% for 1997 and 12% for 1998. In its 1999-2002 Economic Plan, the Government reports a real GDP growth rate of 11% for 1997 and 9.9% for 1998 (Government of Mozambique, 1999). The "Economic Overview" of the privatization program in Mozambique, presented by the privatization unit of the Mozambican Ministry of Planning and Finance (UTRE), states that "under Economic and Social Rehabilitation Program" (PRES), and following the return to peace in 1992, Mozambique has experienced one of the highest average growth rates of any Sub-Saharan African countries with an average rate of 8% from 1993 to 1997 (UTRE, 1999). "Actual growth in 1997 was 6.6% against a forecast of 5.6%" (UTRE, 1999). Figure 2.2 below shows the GDP growth rate.

Figure 2.2: GDP Growth Rate



Source: Author's Calculations

As stated above, growth rate was negative during the 1980s and started picking up during the 1990s, with very significant jump in 1992, the year that marked the end of the civil war in Mozambique.

Development of Higher Education

It has long been recognized by many scholars such as Adam Smith (1776), Becker (1975), Lucas (1988) and Todaro (2006) among others that people are the most precious natural resource a nation possesses. The competitive advantages of a country and its potential for economic growth are directly related to the size of accumulated human capital (Babatunde and Adefabi, 2005). Labour endowed with education, skills and professional experience, determine opportunities and frontiers of change (Todaro, 2006). Investment in human capital can thus be one of the most important sources of economic dynamics and growth. Education plays a key role in the ability of a developing country to absorb modern technology and to develop the capacity for self-sustaining growth and development. (Todaro, 2006)

The acquisition and development of skills embodied in human agents of production is treated as a form of investment. Adam Smith (1776) stressed the importance of investment in human capital to national economic growth. Evidence continues to mount for strong positive association between education levels and productivity growth in both agriculture and non-agricultural sectors. Lockheed et al. (1980) reviewed 18 studies on agricultural productivity and concluded that education had a substantial impact on productivity, though the evidence for Africa was thin.

In order to understand the evolution of Mozambique's higher education system it is important to give an insight of how the political context of Mozambique has shaped the national policy on higher education over the years and how that changed the landscape of the Mozambican higher education system.

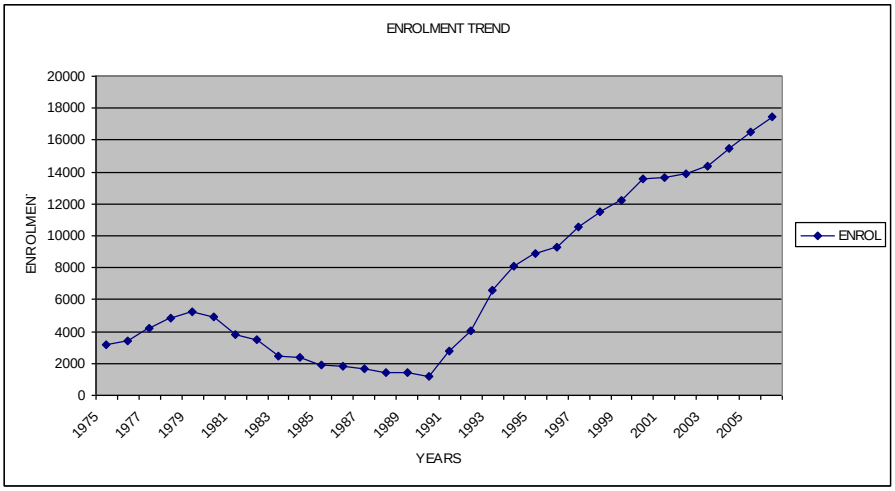
The creation of higher education in Mozambique can be traced back to 1962, when the General University Studies of Mozambique (EGUM) was established during the days of Portuguese colonialism, which mainly catered for the Portuguese people (Chilundo and Berverwijk, 2001). In 1968 the institution changed its name into University of Lourenço Marques (ULM), (MESCT, 2000). Still, few Mozambicans could enroll at this University due to discriminative policies by the Portuguese (MESCT, 2000). Thus, constraining the opportunity for the Mozambicans to participate in the education system.

The political context of Mozambican higher education system

The political transformation brought about by independence in 1975 instituted a number of internal changes in ULM. This culminated in the renaming of the institution after the Mozambican hero, Eduardo Mondlane, to become University of Eduardo Mondlane (UEM) in May 1976. The renaming of the university caused a decline in the number of students from 2,433 in 1975 to 740 in 1978, while the Mozambican teaching staff was reduced to 10 due to exodus of the Portuguese, in an attempt to cripple the education system (MESCT, 2000). In response to this situation, the government hired foreign lecturers, mostly from the eastern bloc and some western countries. The higher education system was refocused to two main objectives, that is, development of national identity and social and economic reorganization (MESCT, 2000).

In the 1980s two new public higher education institutions were established, namely the Pedagogic Higher Institute (ISP) and Higher Institute for International Relations (ISRI). ISP was upgraded to become a Pedagogic University (UP). Its core role is to train teachers, who were desperately needed to respond to the needs of the expansion of the education system for the country. The ISRI on the other hand, trained students for international relations and diplomacy. This expansion of education system brought about expansion in enrolment at all levels of the education system. Figure 2.3 below shows the expansion of enrolment on tertiary education.

Figure 2.3: **Tertiary Enrolment Expansion**



Source: Author's Graph

In 1987 the government introduced market economy which necessitated some structural changes in the social, economic and cultural environment. The changes saw the introduction of private sector and civil society. These institutions fostered the approval of a law in 1993, which allowed the creation of private higher education institutions. Within 10 years, 5 private higher education institutions had been established. Two more public higher education institutions were established later, to bring to 10 the number of higher education institutions in Mozambique (Chilundo and Berverwijk, 2001). In addition, a further expansion of learning opportunities was introduced. The government saw a need of establishing a distance learning program, Mozambique Distance Learning Network, to provide training and institutional capacity building.

However, in 1999 the government acknowledged that the Mozambican higher education system was more of a collection of institutions which did not sufficiently meet the demands of society as a whole. This acknowledgement was reiterated in "The Action Plan for the Reduction of Extreme Poverty (2001-2005), launched by the government, in which it was pointed out that "Mozambique has a dramatic deficit in terms of professionals with higher education" (World Bank, 2001). In response to this and in order to develop the higher

education system, a new Ministry of Higher Education, Science and Technology (MESCT) was created in January 2000. The focus was to bring into being a higher education system that is able to respond to the needs of the Mozambican economy. Thus, the government needed an education system that could support economic growth policies in the country. Table 2.2 below illustrates the structure of the institutions of higher education.

Table 2.2: Higher Education Institutions in Mozambique

Name	Location and Year Founded	Student numbers 2000-2001	2001-2002
Eduardo Mondlane University (UEM)	Maputo 1962 Inhambane (planned 2002)	7307	7083
Pedagogical University (UP)	Maputo 1985 Beira (1990) Nampula (1995) Quelimane (planned 2002)	1399	2210
ACIPOL	Maputo 1999	140	167
Higher Institute for International Relations (ISRI)	Maputo 1986	270	270
Catholic University of Mozambique (UCM)	Beira 1996 Nampula Cuamba (1999) Pemba (planned)	1502	1684
Mussa Bin Bique University (UMBB)	Nampula 1998	52	156
Higher Polytechnic and University Institute (ISPU)	Maputo 1995 Quelimane(1998)	1732	1896
Higher Institute of Sciences and Technology of Mozambique (ISCTEM)	Maputo 1996	809	Not available
Institute of Transport and Communications(ISUTC)	Maputo 1999	83	141
		TOTAL: 13 292	TOTAL: 13 607

Source: Agneta Lind and Adeze Igboemeka (2001)

It can be seen from the table above that the education system in Mozambique is expanding. The core objective was to usher in and respond to the demands of economic growth and development currently underway in the country.

Expenditure on Higher Education in Mozambique

As stated earlier in this study, education has since independence been a priority sector of the Mozambican government. The Gross Domestic Product (GDP) and Total Public Expenditure on Education (TEEP) have increased simultaneously (MESCT, 2000). For instance, total spending for the education sector grew, in nominal terms, about four times between 1992 and 1998, from Mt286 billion to almost Mt1.8 trillion. World Bank, (2003) postulates that total education expenditure grew 9.4% from 1992 to 1998.

In 1999, government expenditure on education was estimated at 14% of the total government budget. About 26% of this expenditure was allocated to higher education, which corresponds to about 4% of Government's total budget (MESCT, 2000). In 2001, the budget allocation to institutions of higher education rose to 22.8%, then to 25% in the next two years, but dropped slightly to 24% in 2004. In this period, the proportion of total public resources allocated to UEM, UP and ISRI was estimated to be constant, at about 20%, 3% and 2.5 %, respectively (MESCT, 2000). External funding represents a large share of total spending. World Bank (2003) argues that about half of total spending on education until 1997 and 45% in 1998 were externally funded.

While the public universities are financed almost entirely by the government and the donor funds, private higher education institutions depend on student fees and external support or venture capital.

Recent developments: Higher Education in the context of poverty alleviation

The current development of the higher education system should be seen in the context of the government's aim to alleviate poverty. The Strategic Plan for Higher Education in Mozambique for the Period 2000-2010 is in line with the central political goals of the current five-year presidential term: the reduction of poverty. Government argues that poverty reduction in Mozambique requires economic growth. In order to reduce poverty, there is need to produce more goods and services for internal consumption and export. Government argues that one key to economic growth is increasing the number of Mozambicans with education (World Bank, 2001).

The Higher Education Strategic Plan (2000-2010) approved by the Cabinet in August 2000 identified three phases of implementation. The first phase (2001-2004) aimed at reforming the sub-sector of Higher Education. The second phase (2005-2007), was the period of expansion, whereas the period (2008-2010), will be the period of consolidation and further planning.

The implementation of the above strategic plan is supported by the World Bank, one of the partners supporting the government of Mozambique in implementing its education plan (MESCT, 2000).

Conclusion

In this chapter we have outlined the evolution of economic growth in Mozambique since independence. The economy was in decline before the end of war but then recovered soon after the war. Evolution of education was evaluated and found that higher education is expanding. More students are enrolled and more institutions of higher education have been built. The importance of education, from both theoretical and empirical point of view has been shown. The government of Mozambique considered education as key to economic growth. From the chapter we have also seen that there was political will to institute reforms in the education system and expenditure on education is increasing. The chapter also stated how the government views education as an instrument for poverty reduction.

III. Literature Review

This chapter reviews both theoretical and empirical literature highlighting the relationship between investment in human capital and economic growth. The theoretical review will show the underpinnings of the study as regard to the theories of human capital. On the other hand, the empirical part will explore studies that have been carried out by different researchers in different countries in the area under review. Theoretical review will be considered first and then followed by empirical evidence.

The Solow (neo-classical) Model

The Solow model[1] - sometimes known as the Solow-Swan model – was developed by Robert Solow and T.W. Swan (1956). It is also known as exogenous growth model or the Neo-classical growth model**,** the term used to sum up the contributions of various authors to a model of long-run economic growth within the framework of neoclassical economics. The Solow model is the theoretical benchmark for most studies of long-run growth of output.[2] It explains how saving, investment and growth respond to population growth and technical change.

Development of the model

The Neo-classical model is an extension to the Harrod-Domar model that included a new term, productivity growth. The most important contribution is probably the work done by Robert Solow (1956). Solow and T.W.Swan (1956) developed a relatively simple growth model which fits available data on US economic growth with some success.

Extension to the Harrod-Domar model

Solow extended the Harrod-Domar model by:

- Adding labor as a factor of production;
- Requiring diminishing returns to labor and capital separately, and constant returns to scale for both factors combined;
- Introducing a time-varying technology variable distinct from capital and labor.

The capital-output and capital-labor ratios are not fixed as they are in the Harrod-Domar model. These refinements allow increasing capital intensity to be distinguished from technological progress.

The Solow model focuses on four variables: output (Y), capital (K), labour (L) and "knowledge" or the "effectiveness of labour" (A). At any time, the economy has some amounts of capital, labour, and knowledge, and these are combined to produce output. The production function takes the form:

$$Y(t) = F(K(t), A(t)L(t)),$$

where t denotes time.

Two features of the production function should be noted. First, time does not enter the production function directly, but only through K, L, and A. In particular, the amount of output obtained from given quantities of capital and labour rises over time – there is technological progress – only if the amount of knowledge increases. The model's critical assumption concerning the production function is that it has constant

[1] The Solow model is the starting point for almost all analyses of growth. Even models that depart fundamentally from Solow's are often best understood through comparison with the Solow model.

[2] Typically measured by growth of real gross domestic product (GDP): the value of all the goods and services produced in an economy during a year.

returns to scale in its two arguments, capital and effective labour.[3] More generally, multiplying both arguments by any nonnegative constant c causes output to change by the same factor:

$$F(cK, cAL) = cF(K, AL)$$

The short run implications of the model are that:

- Policy measures like tax cuts or investment subsidies can affect the steady state level of output but not the long-run growth rate.
- Growth is affected only in the short-run as the economy converges to the new steady state output level.
- The rate of growth as the economy converges to the steady state is determined by the rate of capital accumulation.
- Capital accumulation is in turn determined by the savings rate (the proportion of output used to create more capital rather than being consumed) and the rate of capital depreciation.

Long run implications of the Model

In neoclassical growth models, the long-run rate of growth is exogenously determined - in other words, it is determined outside of the model. A common prediction of these models is that an economy will always converge towards a steady state rate of growth, which depends only on the rate of technological progress and the rate of labor force growth.

A country with a higher saving rate will experience faster growth, for example, Singapore had a 40% saving rate in the period 1960 to 1996 and annual GDP growth of 5-6%, compared with Kenya in the same time period which had a 15% saving rate and annual GDP growth of just 1%. This relationship was anticipated in the earlier models, and is retained in the Solow model; however, in the very long-run capital accumulation appears to be less significant than technological innovation in the Solow model.

Assuming non-zero rates of labor growth complicates matters somewhat, but the basic logic still applies - in the short-run the rate of growth slows as diminishing returns take effect and the economy converges to a constant "steady-state" rate of growth (that is, no economic growth per-capita).

Including non-zero technological progress is very similar to the assumption of non-zero workforce growth, in terms of "effective labor": a new steady state is reached with constant output per worker-hour required for a unit of output. In this case, per-capita output is growing at the rate of technological progress in the "steady-state" (that is, the rate of productivity growth).

However, neoclassical models remain restricted by their underlying assumptions of perfect competition and constant returns to scale. Despite originality, there are some limitations in the Solow model. The first limitation is that, it is built on the assumption of a closed economy. That is, the convergence hypothesis supposes a group of countries having no type of interaction. The second limitation of the Solow model is that the implicit share of income that comes from capital does not match the national accounting information. The third limitation is that, the estimated convergence rate is too low even though attempts to modify the Solow model have impacts on this rate. Finally, the equilibrium rates of growth of the relevant variables depend on the rate of technological progress, an exogenous factor and furthermore, the individuals in the Solow model have no motivation to invent in new goods.

Thus, given the above limitations, new growth theories emerged to augment the Solow model. The primary contribution of the recent theory of endogenous growth, pioneered by Romer (1986), Lucas (1988), and Relelo (1991) has been to endogenise the process through which knowledge is accumulated and thereby the rate of growth itself. Lucas (1988) called for an enlargement of the concept of capital in order to include physical and human.[4] Romer argues that the neoclassical growth model relies on exogenous technological progress as the engine of long-run growth. Romer (1990) formulated, for the first time, an explicit growth model with technical progress resulting from deliberate actions taken by private agents who respond to market incentives. Romer's analysis is based on three premises:

- Economic growth is driven by technological progress as well as capital;
- Technological progress results from deliberate actions taken by private agents who respond to market incentives;
- Technological knowledge is a non-rivalrous input.[5]

Romer (1994), amongst others, stressed the need to make technological advances explainable within the model framework.

[3] Doubling the quantities of capital and effective labour (for example, by doubling K and L with A held fixed) doubles the amount produced.
[4] The later of which consists of education and, sometimes, health.
[5] Modeled as positive knowledge spill-overs.

Hence, the Solow growth model was exhaustively tested in Mankiw, Romer, and Weil (1992). They postulated that the Solow neoclassical model fits the data better, once an additional variable, human capital, is introduced, which improves considerably the original ability to explain income disparities across countries. Thus, Lucas (1988), Romer (1990) and Mankiw, Romer, and Weil (1992), called for the Augmented Solow model that includes the human capital component in the production function.

Augmented Solow Model and Endogenous Growth

Literature on growth contains a number of distinct conceptual rationales for the inclusion of human capital in models of economic growth. According to Sianesi and van Reenen (2003), the two main macro approaches are the augmented Solow model and the new growth theories.

Augmented Solow Model

One way to estimate the impact of education on growth is to adapt the Solow (1956) model. The augmented version extends the basic framework to allow human capital as an extra input into enter the production function. Mankiw et al. (1992), show that traditional growth theory can accommodate human capital and provide a reasonable approximation for empirical analysis. His contribution to the Solow model was the inclusion of the accumulation of human capital, typically in the form of educational attainment.

Human capital as a factor of production

The human capital augmented growth model considers human capital as an independent factor of production (Loening, 2002). The model can be represented in a Cobb-Douglas production function with constant returns to scale as:

$$Y = A.K^{\alpha}.H^{\beta}.L^{(1-\alpha-\beta)}$$

Where Y represents output and A is the level of technology or total factor productivity, K, H and L are physical capital, human capital and labour, respectively.

According to Lucas (1988), who broadened the concept of capital, human capital accumulation may be an engine of growth itself, due to spillover effects that negate diminishing returns in production. Romer (1990) and Grossman and Helpman (1991), argue that domestic technological progress results from the search for innovations. The discovery of an innovation, undertaken by profit-maximizing individuals, raises productivity and is ultimately the source of long-run growth.

Endogenous Growth Theories

Following Solow, a number of growth models have been developed on the issue of endogenous growth[6] in a variety of ways. In these models, technical change may be endogenous and the important issue is to explain the rise in productivity attributable to technical change.

In contrast to the traditional neo-classical Solow growth model, the new growth theories emphasize the endogenous determination of technological progress, which is determined within the model. Thus, long-run growth can be affected by government policies instead of being driven by exogenous technological change. The endogenous growth approach argues that there should be an additional effect over and above the static effect on the level of output, brought about by human capital.

Nelson and Phelps (1966) suggested that education facilitates the adoption and implementation of new technologies, which are continuously invented. Countries with lagging technological capacity may be most able to catch-up if they have a large stock of human capital. Lucas (1990), conjectures that physical capital does not flow from rich to poor countries because of a relatively low stock of complementary human capital. The model of endogenous growth by Romer (1990) assumes that the creation of new ideas is a direct function of human capital, which manifests in the form of knowledge. As a result investment in human capital leads to growth in physical capital which in turn leads to economic growth.

Rebelo (1991) later extended the model by introducing physical capital as an additional input in the human capital accumulation function. While education has no role in traditional neo-classical theories of economic growth, these new approaches have explicitly brought the role of education to the fore (Sianesi et al. 2000). Endogenous growth theories provide the theoretical underpinnings for assuming that education can affect national economic growth via two main channels:

[6] What factors determine the steady-state income levels.

Human capital is explicitly incorporated as a factor input in the production function, explicitly modeling individual educational investment choices, as well as by often allowing human capital to have external effects, thus departing from the constant returns to scale assumption.

The factors leading to endogenous growth (in particular technological change) are explicitly related to the stock of human capital. This may be either because human capital is assumed to directly produce new knowledge/technology, or because it is an essential input into a research sector which generates new knowledge/technology.

Empirical Evidence

Many studies have been carried out in the field of investment in human capital in both developed and developing countries. This section reviews such studies, bringing to light their findings. It is important from the onset, to state that these studies have produced conflicting results on the relationship between human capital and economic growth. The literature to be reviewed will include both developed and developing countries.

Developed Countries Empirical Evidence

One of the better known and most influential contributions to growth literature is the study by Mankiw et al. (1992). It used an augmented Solow model to explain cross country differences in income levels from 1960 to 1985. Human capital, as proxied by secondary school enrolment ratios, accounted for almost half the difference in per capita incomes. For non-oil countries, a 1% increase in the average percentage of the working-age population in secondary school is estimated to lead to a 0.66% increase in long-term income per capita.

Koman and Marin (1999) applied an augmented Solow model, in a time series framework, to explain economic growth trends in German and Austria. They found that the specification and incorporation of a variable measuring the accumulation of broadly-defined human capital led to insignificant estimates.

Gemmell (1996) worked on OECD data sets and his original contribution involved the construction of some alternative measures of human capital based on both stocks and annual average growth rates at primary, secondary and tertiary education levels. He found that a 1% increase in initial tertiary human stock was associated with a 1.1% increase in per capita GDP growth, while a 1% increase in subsequent growth in tertiary education (flow) was associated with almost 6% output growth. While the direct growth effects come through tertiary education, secondary education was found to have an indirect impact though its positive significant association with physical investment.

Jenkins (1995) carried out a study for the UK. He used annual data from 1971 to 1992 and proxied the stock of human capital by three series measuring workforce qualifications. These series were used as key determinants of aggregate output, alongside physical capital, total workforce, capacity utilization and a time trend. The overall result confirmed the finding that investment in human capital increases productivity. High-qualified workers are found to contribute almost twice as much to productive efficiency as those with no qualifications at all.

Asteriou and Agiomirgianakis (2001) used cointegrated regressions to explore the long-term relationship between formal education and GDP in the Greek economy. They found a significant relationship between primary, secondary and higher education enrolments and GDP per capita. The main direction of causality ran through the education variables to economic growth, but in the case of higher education, there exist reverse causality.

In a recent development, Gupta and Chakraborty (2004) develop an endogenous growth model of a dual economy where human capital accumulation is the source of economic growth. They argued that the duality between the rich individuals exists in the mechanism of human capital accumulation. Rich individuals allocate labour time not only for their own production and knowledge accumulation but also train the poor individuals. In a different dimension, Bratti et al. (2004) estimated a model of economic growth and human capital accumulation based on a sample of countries at a different stage of development. Their result revealed that the increase in the primary and secondary level education contributes to an increase in productivity. They posit that human capital accumulation rates are affected by demographic variables. For example, they established that an increase in life expectancy at birth brings about an increase in secondary and tertiary education while a decrease in the juvenile dependence rate negatively affects secondary education. Finally, they added that geographic variables have a considerable importance in the human capital accumulation process. Nevertheless, studies differed on the impact of human capital on productivity growth.

Haouas and Yagoubi (2005) examined openness and human capital as sources of productivity growth for MENA countries. Controlling for fixed effects as well as endogeneity in the model, they found that human capital significantly influence growth. Park (2004) empirically investigates the growth implication of dispersion of distribution in terms of educational attainment levels. Based on a pooled 5-year interval time-series data set of 94 developed and developing countries between 1960 and 1965. He finds that the dispersion index as well as

average index of human capital positively influences productivity growth. He concludes that education policy that creates more dispersion in the human capital will promote growth.

Similarly, but in a slightly different manner, Barro's original (1991) study used data for 98 countries from 1960 to 1985. He related the real growth rate of GDP per capita to initial human capital, proxied by school enrolment rates for 1960. It found that output growth was significantly positively determined by both primary and secondary school enrolment.

Developing Countries Empirical Evidence

Elias and Fernadez (2000) carried out a study on human capital investment, income levels and economic growth in twenty-four Latin American economies. They analysed the empirical relationship among per capita growth rate and human capital level, using primary, secondary and tertiary school enrolment as proxy for human capital. They found that the rate of primary schooling was highly significant and with the positive sign while secondary and high school had a negative sign. The incorporation of a dummy variable in their model, that turned out to be negative and very significant, allowed them to infer that countries with low and middle low incomes should have grown little due to a low investment rate in education.

Loening (2002) carried out a study in Guatemala investigating the impact of human capital on economic growth during 1951-2002 using an error-correction methodology. He examined two different channels by which human capital is expected to influence growth. The result from his study revealed that a better-educated labour force appears to have a positive and significant impact on economic growth via factor accumulation as well as on the evolution of total factor productivity.[7]

Musibau and Rasak (2005) carried out a study to investigate the long-run relationship between education and economic growth in Nigeria between 1970 and 2003. The study examined two different channels through which human capital can affect long-run economic growth. First, when human capital is a direct input in the production function and second, when human capital affects the technology parameter. They found a long-run relationship between education and economic growth. A well educated labour force appears to significantly influence economic growth both as a factor of the production function and through total factor productivity.

Abbas (2007) investigated the relationship between human capital and economic growth in Pakistan during the period 1960 to 2003. The aggregate production function results reject the endogenous growth formulation but indicate broadly similar productivity of secondary schooling to that in the OECD economies. They followed Barro and Lee (2000), and measured the stock of human capital at the secondary level of education as the percentage of the workforce of who has completed secondary education.

Conclusion

The chapter has outlined the theoretical and empirical literature on the relationship between human capital and economic growth. The empirical literature in both developed and developing countries has shown that to a large extent, the accumulation of human capital stock provides for long-term economic growth. However, more studies have been carried out in developed countries as compared to developing countries. Thus, there is need to carry out more studies in developing countries in order to come up with more evidence which assists the policy makers. In this respect, Mozambique should not be an exception. The next chapter presents the methodology to be adopted in this study.

IV. Methodology

In this chapter we develop and specify an empirical model to capture the relationship between investment in human capital and economic growth in Mozambique. Annual time series data from 1975 to 2006 is used in this study. We follow Loening's (2002) model, but we will consider **gross enrolment**. Our view is that education at all levels has a significant contribution to economic growth.

Theoretical Model

Loening (2002) included human capital as an independent factor of production, in the Cobb-Douglas production function as illustrated below:

$$Y = AK^{\gamma}H^{\theta}L^{(1-\gamma-\theta)} \qquad (4.1)$$

where Y is output, A is the total factor productivity, K is physical capital, H is human capital and L is labour

.

[7] The paper was originally prepared as a background study for Guatemala's 2005 Country Economic Memorandum.

$$Y = AK^{\gamma} H^{\theta} L^{(1-\gamma-\theta)} \quad (4.2)$$

Our model, unlike Loening (2002), considers human capital as gross enrolment. Higher level of human capital speeds up the adoption of foreign technology that is expected to balance the knowledge gap between developed and developing countries (Nelson and Phelps (1966), Lee (1995), Benhabid and Spiegel (1994), Loening (2002**).**

In order to linearize equation (4.2), we express it as a logarithmic function, so that the coefficients can be interpreted as elasticities. We also standardize the function by dividing each variable by labour. Standardizing output and capital stock by labour units avoid multicollinearity between capital and labour (Loening, 2002). Equation (4.2) can now be estimated as:

$$Lny_t = LnA + \gamma.Lnk_t + \theta.Lnh_t + u_t \quad (4.3)$$

where the lower case variables y = Y/L and k = K/L are output per worker and capital per worker respectively and h = H/L stand for average human capital.

Lny_t = Log of output per worker

Lnk_t = Log of capital per worker

Lnh_t = Log of average human capital

u_t = Stochastic error term

We also include a dummy in order to capture the effects of war in Mozambique. In its error correction form equation (4.3) can now be represented as:

$$\Delta Lny_t = \beta_0 + \beta_1 \Delta Lnk_t + \beta_2 \Delta Lnh_t + \beta_3 ECM_{t-1} + \beta_4 Dummy_t + u_t \quad (4.4)$$

Where Δ represent changes in the variables, β s are coefficients of adjustments which we sought to estimate. The error-correction term, ECM_{t-1}, can be represented as:

$$ECM_{t-1} = Lny_t - (LnA + \gamma.Lnk_t + \theta.Lnh_t) \quad (4.5)$$

ECM_{t-1} Describes the speed of adjustment through which the system moves back to its long run equilibrium. It measures the proportion of previous period's equilibrium error that is corrected for in the current period. The coefficient β_3 represents the measure of speed of adjustment through which the system moves back towards its log run equilibrium. β_3 is expected to have a negative sign to indicate that the system will converge to its long-run equilibrium relationship. Positive sign imply that the variable will adjust and push the system into further disequilibrium. The long-run model (4.3) and the error-correction model (4.4) are going to be estimated.

Estimation techniques and procedure

The Engle and Granger (1987) two-step procedure to test for cointegration between our variables will be used. The first step uses the unit root test, to test for stationarity of the variables and to determine their order of integration. The Augmented Dickey-Fuller (ADF) unit root test is adopted for this purpose. A long-run cointegration regression is also estimated using Ordinary Least Squares (OLS). The ADF tests the null hypothesis (H_0) that a variable is non-stationary against the alternative hypothesis (H_1) that it is stationary. Failure to reject the null hypothesis implies that the time series is non-stationary at a given significance level and therefore it requires taking first or higher order differencing of the level data to establish stationarity. Engle and Granger (1987) prefer the ADF test due to the stability of its critical values as well as its power to different sampling experiments.

Having tested the Stationarity of each time series, the second step is to search for cointegration between the variables. This step involves testing the Stationarity of the residuals of the cointegration regression generated in the first step. If the residuals are stationary, it implies that cointegration exists. The presence of cointegration implies that a long run relationship exists among the variables. We then proceed to test the error correction

model to capture short-run dynamics. However, in the absence of cointegration, a Vector Autoregression (VAR) in first differences form can be constructed. Estimation is through E-views software version 5.0.

Definition and justification of variables

Dependent variable (y_t)

The dependent variable (y_t) is output per worker (real GDP per worker) and is the proxy for economic growth. We assume that only those in the labour force contribute to the generation of output which reflects domestic productive capacity. It truly measures production or economic growth within the country unlike GNP which incorporates output from outside the country. Green and Villanueva (1992) postulate that countries with higher per capita income are able to channel more resources to domestic savings which could be used to finance investment projects, critical for economic growth.

Independent variables

Capital per worker (k_t)

Capital (k_t) is a factor input in the production function which we used to derive our model. Human capital and physical capital may also be complementary. It is not a question of either investing in people or investing in machines, both are necessary (Appleton and Teal, 1998). We use gross fixed capital formation (GFCF) to proxy capital **(k_t)** and divide it by labour to obtain capital per worker (k_t). Because of inherent difficulties in measuring physical capital stock, and the uncertainties associated with using popular methods such as the Perpetual Inventory Method (PIM) which requires information about initial capital stock and make assumption on the rate of depreciation (Medina-Smith, 2001), we resort to using GFCF as a proxy for k_t . It is also worth to note that most studies that estimate the relationship between investment in human capital and economic growth used this variable (see e.g. Babatunde and Adefabi, 2005). This variable is expected to have a positive relationship with economic growth.

Average Human capital (h_t)

Human capital refers to skills and knowledge embodied in human beings, which allow them to be efficient and innovative. In this study human capital is proxed by tertiary enrolment .The average human capital variable (h_t), is obtained by dividing gross enrolment by labour (H/L). Barro (2000) maintains that an educated workforce facilitates the absorption of technologies. Loening (2002) considered human capital as an independent factor of production. This approach has remained the workhorse of empirical research (Solow, 1956). Loening (2002) found that a better-educated labour force has a positive and significant impact on economic growth. This is expected to be the case in Mozambique. Under the endogenous growth theory, human capital is assumed to positively affect technical progress (Romer 1986, Lucas 1988, Barro 1996), which in turn causes economic growth.

Dummy ($Dummy_t$)

Dummy is a qualitative variable, included in the model in order to capture the effects of war in Mozambique. It takes the value of 1 from 1980 to 1991 when there was war and 0 otherwise. It is assumed that war inhibits human capital development for example, by displacing people from the locations where there is access to education which retards the economic growth process. Thus we expect the sign of $Dummy_t$ to be negative.

Data Collection and limitations

The study employs annual time series data, GDP, capital, tertiary enrolment and labour force. The GDP, tertiary enrolment and labour force were collected from official central statistical office (INE) publications, the Central Bank of Mozambique (BM) and the Ministry of Labour (INFP), respectively.

Conclusion

In this chapter, we explain how we develop the model we are going to use in our study and the estimation techniques we adopt. We also give a brief justification of the variables that we are using. Data issues and limitations are also outlined. In the succeeding chapter, we do the actual estimation and interpretation of results.

V. Estimation and Results

In this chapter we undertake data analysis where the summary statistics will be presented, followed by stationarity tests for the variables. Thereafter, cointegration test for the model and the error correction term will be undertaken, to capture the speed of the adjustment parameters.

Descriptive Statistics

The preliminary data analysis in the form of summary statistics is presented in the table 5.1 below.

Table 5.1: Summary Statistics

Variable	Observations	Mean	Standard dev	Minimum	Maximum
Lny	32	0.129219	0.110574	-0.072897	0.331398
Lnk	32	-14.39005	0.224963	-14.77626	-14.02517
Lnh	32	-0.882375	0.096262	-1.070682	-0.704977

The table above summarises logarithms of mean proportions of output, capital and human capital to labour. The negative sign for human capital indicates that enrollment was consistently lower than labour units for the period under review, since the log of a number below zero is always negative. The same applies for capital. The minimum and maximum statistics do not indicate any outliers. There is low variation in all variables, as can be depicted by the standard deviation.

Stationarity Tests

The unit root test on the time series macro-variables is performed. This is because macroeconomic time series have unit roots and, regressing non- stationary series is bound to yield spurious regression results. The data were first subjected to stationarity tests in levels, using the Augmented Dickey - Fuller test. The interpretation of unit roots test is based on the comparison of absolute value of the calculated ADF statistic with the absolute critical values. The results of stationarity test in levels are shown in table 5.2 below.

Table 5.2: Stationarity tests of variables in levels

Variable	t-ADF	1%	5%	Remark
Ly	-2.431266	-4.2949	-3.5670	nonstationary
Lk	-2.448002	-4.2949	-3.5670	nonstationary
Lh	-2.432046	-4.2949	-3.5670	nonstationary

L denotes the logarithm of the variable

It can be seen from table 5.2 above that the variables are non-stationary in levels at both 1% and 5% levels of significance. The calculated t-values are less than the critical values in absolute terms. Hence, the series were differenced in order to make them stationary. The results are presented in table 5.3.

Table 5.3: Stationarity tests for differenced variables

Variable	t-ADF	1%	5%	Remark	Order of integration
DLy	-3.37068*	-2.6453	-1.9530	stationary	I(1)
DLk	-3.137368*	-2.6453	-1.9530	stationary	I(1)
DLh	-3.190416*	-2.6453	-1.9530	stationary	I(1)

* stationarity at 1%.

Table 5.3 indicates that the absolute values of the calculated t-values are greater than the critical values at the 1% and 5% level of significance, respectively. Hence, we reject the null hypothesis and conclude that the differenced series are stationary. The series are now integrated of the same order, I (1). We proceed to test for cointegration.

Cointegration Test

Here we test for cointegration among the series by employing the Engle-Granger two step procedures. According to Engle-Granger (1987) the long run model is estimated in levels. The results are presented in table 5.4 below.

Table 5.4: GDP long run model (in levels)

Variable	Coefficient	Standard error	t-statistic	Probability
Constant	2.558160	1.223306	2.091187	0.0454
Lnk	0.139941	0.082250	1.701403	0.0996
Lnh	0.470531	0.192219	2.447898	0.0207

The residuals (ε_t) from the long run model should be stationary in levels (Engle-Granger, 1987). We tested the residuals and found that the calculated t-statistic of the residuals is -2.026654 against the critical value of -1.952473at 5% level of significance. This means that the residuals are stationary. This indicates the existence of cointegration among the variables. The error term is used in the short run model in order to capture the speed of the adjustment.

It should be noted that the standard errors, and the t-statistic of the coefficients of the long run model, cannot be expected to give meaningful results, because the variables are estimated on non-stationary series. The importance of the long run model is in providing the residuals needed to run the error correction model (Engle-Granger, 1987). Therefore, we proceed to run the short run model.

The Error Correction Model (ECM)

The existence of cointegration among variables means there is a long run relationship. Therefore, we apply the Error Correction Model to adjust for disequilibrium between short and long run series (Maddala, 1997). The results of the estimated model are presented in table 5.5.

Table 5.5: Error Correction Estimates for GDP

Variable	Coefficient	Standard error	t-statistic	Probability
Constant	0.023408	0.002949	7.937759	0.0000
DLnk	0.415506	0.016276	25.52866	0.0000
DLnh	0.175657	0.047778	3.676569	0.0011
Dummy	-0.021906	0.004879	-4.490329	0.0001
ε_t (-1)	-0.121969	0.023500	-5.190095	0.0000

Diagnostic tests

R-squared = 0.972471
Adj R-squared = 0.968236
D-W = 2.04
F-Statistic = 229.6140
Prob (F-Statistic) = 0.000000

Jarque-Bera: F(1,22) 0.841236 [0.656641]
White's test: F(1,23) 1.201782 [0.341007]
L-M test: F(2,24) 1.381289 [0.270520]
RESET test F(1,25) 0.258026 [0.615932]

Discussion of Diagnostic tests

The model is well fitted as shown by the probability of the F-statistic. The adjusted R-squared indicates that about 97% of variations in economic growth are explained by variations in the explanatory variables. Ramsey-RESET test also indicates that the model is correctly specified since the probability of 0.616 shows that the null hypothesis of an incorrect specification is rejected. The model also passes the normality test as indicated by the Jarque-Bera test probability of 0.657. White's Heteroskedasticity test confirms also that there is no heteroskedasticity in our model. Finally our model also passes the autocorrelation test as indicated by the L-M test.

Discussion and interpretation of results

Human capital coefficient is positive and it is significant at 1%. According to the results, a 1% increase in human capital will increase output by 18%. This is in line with theory that states, human capital accumulation is an engine of growth, due to spillover effects that negate diminishing returns in production (Lucas, 1988). Romer (1990), states that the discovery of innovation, undertaken by profit-maximizing individuals, raises productivity and is ultimately the source of long-run growth. Loening (2002) in Guatemala and Babatunde and Adefabi (2005) in Nigeria obtained similar results. The results imply that Mozambique will increase growth by increasing investment in human capital. Barro (2000) maintains that an educated workforce facilitates the absorption of technologies.

The capital variable is positively related to economic growth. Its coefficient is statistically significant at 1%. The results imply that a 1% increase in gross capital formation leads to a 42% increase in economic growth. Thus, capital plays an important role in Mozambique's economic growth process. Loening (2002) found similar results in Guatemala. His results showed that a 1% increase in capital leads to a 55% increase in GDP.

The dummy variable indicates that the civil war in Mozambique impacted negatively on economic growth. Its coefficient is statistically significant at 1%. Political and macroeconomic instability during the civil war affected both economic growth and investment in human capital, negatively.

The speed of adjustment coefficient has the expected negative sign and is statistically significant at 1%. The results imply that if there is a shock in the system, approximately 12% of the deviation is corrected within the first period. This is rather slow adjustment process.

Conclusion

The unit root tests revealed that the variables were non-stationary in levels but became stationary after they were differenced once. Being stationary of the same order, cointegration test was carried out. The error correction term was found to be statistically significant at 1%. The results are not different from those of Babatunde and Adefabi (2005) in Nigeria. They found that the human capital variable has a positive relationship with economic growth. The next chapter will outline the conclusions and policy recommendations based on our results.

VI. Conclusions and Policy Recommendations

This chapter concludes the study by giving the summary and outlining the findings of the study. It further presents the policy implications obtained from the results. Policy recommendations will be outlined, in order to improve the existing policy measures. The study's limitations will also be presented, followed by of the study's suggested areas for further research.

Summary and Main Findings of the study

The main objective of this study was to analyze the relationship between human capital and economic growth in Mozambique. The study employed a Cointegration technique by Engle-Granger. Annual time series data was used for the period 1975 to 2006. The results indicate that there is a long run relationship between human capital (enrolment in tertiary level) and economic growth. The study was also able to establish long run relations among the other variables, namely, capital.

Human capital was considered a direct input into the production function. The results revealed that human capital is important for economic growth. A good performance of an economy, in terms of economic growth, may therefore be attributed to a well-developed human capital base.

Policy Recommendations

The results of this study showed a positive long run relationship between human capital and economic growth. These results have far reaching policy implications as they suggest that the development of skills and knowledge, coupled with their effective utilization is important for the country's development. A major policy implication of our results is that concerted effort should be made by policy makers to increase the level of human capital in Mozambique. In the light of such empirical results, it is important that real expenditures on human capital development are not allowed to fall and efforts should be made to maintain adequate levels of human capital investment. The study therefore supports the human capital theory as a source of economic growth.

In chapter two, we stated that the government of Mozambique intends to reduce absolute poverty by 30% by year 2020. Thus, investment in human capital can be seen as a vehicle through which economic growth can be achieved. Human capital is also important for poverty reduction.

Since the capital coefficient is positive and statistically significant, we recommend that the government of Mozambique increase this variable by attracting more investment, as it can contribute about 42% to economic growth.

Limitations of the Study

In the process of data capturing, we encountered numerous difficulties. Inaccessibility and data inconsistency were some of the problems encountered. It is our view that a systematic data collection process enhances the quality of results of studies such as this one. Because of the above stated problems, this study could not use some of the variables because they could not give any meaningful results. Hence fewer variables were used.

Areas for Further Research

The relationship between human capital and economic growth can be investigated in various ways. We suggest that further research could be undertaken in area of health.

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APPENDIX

Data used in the Regression

obs	DLNGDP	DLNH	DLNK	DAMMY
1975	NA	NA	NA	0.000000
1976	0.058497	0.003986	0.037504	0.000000
1977	0.066517	0.054288	0.073037	0.000000
1978	0.058302	-0.026856	0.018755	0.000000
1979	0.020966	-0.005093	-0.039743	0.000000
1980	-0.079073	0.018889	-0.238513	1.000000
1981	0.055362	-0.004556	0.119611	1.000000
1982	-0.033004	0.062871	-0.132300	1.000000
1983	-0.128965	-0.051817	-0.330592	1.000000
1984	-0.032808	-0.016625	-0.086197	1.000000
1985	0.062918	-0.022540	0.095960	1.000000
1986	0.037623	-0.032373	0.047312	1.000000
1987	0.252222	0.084960	0.539537	1.000000
1988	-0.066338	-0.099891	-0.026494	1.000000
1989	0.017081	-0.055959	0.094782	1.000000
1990	-0.014596	-0.014046	-0.035482	1.000000
1991	-0.065825	-0.060036	-0.120102	1.000000
1992	-0.043171	-0.021637	-0.087555	0.000000
1993	0.007132	0.098033	-0.045480	0.000000
1994	-0.099937	-0.062398	-0.259474	0.000000
1995	0.027441	0.042576	-0.002693	0.000000
1996	0.033863	-0.000588	0.018135	0.000000
1997	0.034489	-0.008187	0.010111	0.000000
1998	0.036119	0.133863	0.008138	0.000000
1999	0.004501	0.002329	-0.034731	0.000000
2000	0.018342	0.015830	0.011435	0.000000
2001	0.030952	-0.008527	-0.027077	0.000000
2002	0.033075	-0.000693	0.036571	0.000000
2003	0.051953	0.076766	0.061724	0.000000
2004	-0.000739	0.075655	-0.044511	0.000000
2005	0.039259	0.001046	0.041376	0.000000
2006	0.007932	-0.002160	0.008046	0.000000