DISSERTATION

BANK EFFICIENCY AND ECONOMIC GROWTH: AN EMPIRICAL ANALYSIS OF THE ECONOMIES OF THE EAST AFRICAN COMMUNITY (EAC) COUNTRIES

Submitted by

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WE HEREBY RECOMMEND THAT THE DISSERTATION PREPARED UNDER OUR SUPERVISION BY PANTALEO J. KESSY ENTITLED "BANK EFFICIENCY AND ECONOMIC GROWTH: AN EMPIRICAL ANALYSIS OF THE ECONOMIES OF THE EAST AFRICAN COMMUNITY (EAC) COUNTRIES" BE ACCEPTED AS FULFILLING IN PART REQUIREMENTS FOR THE DEGREE OF DOCTOR OF PHILOSOPHY.

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ABSTRACT OF DISSERTATION

BANK EFFICIENCY AND ECONOMIC GROWTH: AN EMPIRICAL ANALYSIS OF THE ECONOMIES OF THE EAST AFRICAN COMMUNITY (EAC) COUNTRIES

Following the relatively poor economic performance experienced by Sub-Sahara African countries during 1970s and 80s, many of these nations have increasingly relied on the private sector and market signals to direct the allocation of resources. However, a private sector –led growth strategy has little chance of success unless effective and sustainable support is forthcoming from the financial sector. The degree to which the private sector contributes to economic growth will depend *inter alia* on the extent to which the sector can gain access to crucial financial services, such as credit, payment system and risk management services. Efficient financial systems are, therefore, necessary if greater reliance is to be placed on voluntary, market-based decision-making systems. Financial intermediaries direct resources to their most efficient uses by evaluating alternative investments and monitoring the activities of borrowers. However, despite of the growing importance of the empirical studies on finance-growth nexus, the relationship between financial sector and economic growth in Sub-Sahara African countries has been largely ignored in the available empirical literature.

In this dissertation, we analyse the link between financial sector and economic growth using a fixed-effects model and balanced panel data from three East African countries, namely, Tanzania, Kenya and Uganda, during the period 1994 – 2005. We concentrate

on banking sectors as they typically dominate financial intermediation in these countries. We consider both the qualitative and quantitative aspects of the banking sectors and measure the qualitative development in the sectors with the commercial banks' efficiency. As in many earlier studies, the quantitative development of banking sectors is measured by the amount of bank credit allocated to the private sector as a share of GDP.

We first estimate bank efficiency in the three countries using Data Envelopment Analysis (DEA) model, and compare how the efficiency scores vary across the countries and overtime. We then use the efficiency scores to measure the importance of a well-functioning financial system to the country's economic growth. We also investigate two potential transmission mechanisms through which the financial sector can affect economic growth. The two hypothesized transmission mechanisms are through improved capital productivity and through increased volume of savings. The general hypothesis of this dissertation is that banks are essential for economic growth, because they perform the function of allocating financial resources by selecting and monitoring of entrepreneurs.

The empirical analysis of the effects of the financial system efficiency on the economic growth is based on an equation relating GDP growth to bank efficiency scores and credit to the private sector as explanatory variables, while controlling for other factors. The empirical results of the study are consistent with the above hypothesis, as the bank efficiency variable is found to be positive and statistically significant for all specifications considered. The coefficient of the commercial banks' credit to the private sector is also statistically significant with the expected positive sign, suggesting that the credit

allocated to the private sector by commercial banks has a positive impact on economic growth. To examine the two hypothesized channels of transmission, we test whether commercial banks efficiency variable has positive effects on the *average productivity of capital* and *level of savings* on one hand, and on the other hand we test whether these intermediate variables have positive effects on GDP growth. The empirical results confirm that commercial banks' efficiency is positively associated with both the average capital productivity and level of savings. In addition, the results suggest that these intermediate variables are positively and statistically related to GDP growth.

In a nutshell, the empirical findings of this study point out to the existence of an independent effects exerted by financial system efficiency on real growth and that financial system efficiency affects real sector mainly through capital productivity improvement and an increase in the level of savings.

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DEDICATION

This dissertation is dedicated to my sons **JULIUS** and **WISDOM** for their endurance

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CHAPTER ONE

Background to the Problem

1.1 Introduction

The East African Community (EAC) comprises the countries of Kenya, Tanzania and Uganda. The three countries share a common political and economic history that dates back to the colonial period. After the First World War, the three countries were placed under British rule and they formed a currency area region which shared a common currency – East African shilling. The currency was issued by the East African Currency Board (EACB) which was established in December, 1919 to manage the supply and exchange of currency in the three countries. During this period, all commercial banks and other financial institutions in the region were foreign owned, with their headquarters and most of their business operations outside East Africa.

After political independence in early 1960s, the three countries, albeit to different degrees, pursued inward-looking economic development strategies, emphasizing a key role of the state in economic activity to accelerate economic development. In Tanzania for example, where the role of state was most pronounced, the economy was managed through central planning and public ownership, and the role of private sector was considerably limited. Kenya maintained a more market-oriented economy, but government intervention was very high during 1960's and 70's. Excessive government intervention together with the stagnation of export prices, deterioration of terms of trade

and rising interest rates in international financial markets, adversely affected the performance of the three economies mostly during the second half of 1970s and 80s.

By the late 1980s the three countries were facing increasing economic difficulties, including high rates of inflation, low economic growth rates, low income per capita, widening interest rate spreads, rising external debt and low savings rates among others. Given this experience, the three countries embarked on wide ranging structural adjustment reforms with the help of the International Monetary Fund (IMF) and the World Bank. The key objectives of reforms were to reduce direct government involvement, which translated to privatization, and strengthening of the role of market forces in the allocation of economic resources. Consequently, financial sector reforms formed a major and important part of the entire structural adjustments programs in all the three countries. Financial sector reforms in Kenya began in 1989 while in Tanzania and Uganda the reforms were initiated in 1991 and 1992 respectively. Essentially, financial sector reforms in these countries involved two distinct but complementary types of changes. The first type of change was the liberalization of the sector, which means allowing the private sector rather than the government, to make decisions pertaining to credit allocation and interest rates. Second, was the establishment of the prudential supervision designed to compel the private sector to make decisions that broadly take in to account the general interests of the society. The broad objectives of these changes were to improve the capacity of financial institutions to mobilize domestic savings, enhance the effectiveness of monetary policy instruments, and to promote competition among banks in order to improve their efficiency.

As more than fifteen years have now elapsed since the initiation of the financial sector reforms in these countries, it is appropriate to take stock of the efforts being put in this endeavor. In this dissertation we therefore, attempt to pursue this goal by studying the efficiency of commercial banks in relation to economic growth in the three East African states.

1.2 Recent Economic Performance in the Region

As table 1.1 below shows, the three EAC member states had a combined GDP of $ 33.3 billion in 2004. Kenya is the largest of the three economies, with a GDP of $ 15.6 billion in 2004, a population of 32.4 million and a per capita GDP of $ 342.7. Tanzania is the second largest economy with a GDP of $ 10.9 billion, a population of 36.6 million and GDP per capita of $ 322, in the same year. Uganda's GDP in 2004 was $ 6.8 billion, and it had a population of 25.9 million and per capita GDP of $ 285.2. During the period from 1990 to 2004, Uganda and Tanzania have shown a strong economic performance while Kenya has generally experienced a sluggish economic growth. Tanzania's growth was modest in the early 1990s but accelerated dramatically in the second half of the decade. From 1990 to 1995, the economy grew at an annual rate of 2.5 percent. Since 1995, growth has picked up, with real GDP increasing at an annual rate of 5.2 percent, exceeding seven percent in 2002 and 2003. Except in 1994 and 1995, Tanzania grew faster than Kenya during the period 1990 to 2004, and in the past few years, it has also grown faster than Uganda. This strong growth performance reflects the fruits of responsible monetary and fiscal policies, concerted reforms, rapid export growth, and significant debt relief.

Table 1.1 Financial and other macroeconomic indicators for EAC countries

Kenya

Indicators	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Narrow money, M1	27,529	31,667	46,577	59,322	66,792	69,333	78,995	91,037	94,092	109,506	118,968	126,332	149,712	194,119	210,910
Quasi money	30,571	37,804	50,003	64,332	95,755	133,520	175,401	210,888	215,615	218,788	224,051	225,233	242,968	245,313	289,256
Broad money,M2	58,099	69,471	96,579	123,654	162,547	202,853	254,395	301,924	309,707	328,293	343,019	351,565	392,680	439,432	500,166
Broadmoney (as % of GDP)	27	29	32	38	36	39	43	45	44	43	42	40	39	38	38
Domestic Credit	*70356*	*83821*	*98554*	*96935*	*145142*	*198877*	*236037*	*285817*	311661	341495	345964	357093	390088	423482	484608
Gross Domestic savings (Current $ mil)	1,592	1,587	1,357	1,298	1,580	1,380	1,391	1,192	1,458	1,376	1,198	1,472	1,691	1,951	2,034
Gross Domestic Savings (% of GDP)	19	19	17	23	22	15	12	9	10	11	9	11	13	13	13
Gross domestic investment(% of GDP)	21	19	17	17	19	21	16	15	16	16	17	18	17	16	16
GDP (Current $ Billions)	8.6	8.0	8.0	5.0	7.1	9.0	9.3	10.6	11.5	10.6	10.5	11.2	12.2	14.4	15.6
GDP growth	4.2	1.4	-0.8	0.4	2.6	4.4	4.1	2.1	1.6	1.3	-0.2	1.1	1.2	1.8	2.1
GDP per capita ($)	378.6	373.5	360.5	352.3	352.3	358.5	364.2	362.7	359.9	356.0	347.4	344.0	341.3	341.3	342.7
Domestic credit (as % of GDP)	52.9	55.1	55.5	53.4	52.0	53.8	52.8	51.6	50.0	50.2	47.8	43.7	43.5	40.6	40.8
Credit to private sector(% of GDP)	32.8	34.2	35.7	33.8	29.1	34.1	34.7	33.8	30.7	30.7	29.8	25.0	23.6	21.3	23.2
Inflation rate	17.8	20.1	27.3	46.0	28.8	1.6	8.9	11.4	6.7	5.7	10.0	5.7	2.0	9.8	11.6
Exchange rate	23	28	32	58	56	51	57	59	60	70	76	79	79	76	79
Population	*23.4*	*24.0*	*24.7*	*25.3*	*26.0*	*26.7*	*27.4*	*28.0*	*28.7*	*29.4*	*30.1*	*30.7*	*31.3*	*31.9*	*32.4*
Population growth rate	3.0	2.8	2.7	2.7	2.6	2.6	2.5	2.5	2.4	2.4	2.3	2.1	2.0	1.8	1.7

Tanzania

Indicators	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Narrow money, M1	113,002	138,803	186,118	247,328	329,626	428,284	449,214	493,869	545,517	632,582	695,007	766,020	958,787	1,113,379	1,315,605
Quasi money	52,332	76,262	116,243	173,624	240,119	329,521	372,282	433,200	481,467	584,948	702,682	870,711	1,088,896	1,274,937	1,532,391
Broad money,M2	*165,335*	*215,064*	*302,360*	*420,952*	*569,745*	*757,805*	*821,496*	*927,069*	*1,026,984*	*1,217,530*	*1,397,689*	*1,636,731*	2,047,683	2,388,316	2,847,996
Broad money (as % of GDP)	17	18	19	21	22	22	21	19	18	17	18	18	20	21	22
Domestic Credit	287355	325797	401596	560886	623095	693880	591599	584313	681392	835360	873270	805591	907293	902078	1083985
Gross Domestic savings (Current $ mil)	54	147	15	(196)	74	100	237	378	(71)	244	843	809	1,132	982	960
Gross Domestic Savings (% of GDP)	1	3	0	(5)	2	2	4	5	(1)	3	9	9	12	10	9
Gross domestic investment(% of GDP)	26	26	27	25	24	20	16	15	14	15	17	17	19	18	19
GDP (Current $ Billions)	4.3	5.0	4.6	4.3	4.5	5.3	6.5	7.7	8.4	8.6	9.1	9.4	9.8	10.3	10.9
GDP growth	7.0	2.1	0.6	1.2	1.6	3.6	4.6	3.5	3.7	3.5	5.1	6.2	7.2	7.1	6.3
GDP per capita ($)	267.0	264.2	257.6	252.9	249.3	250.8	255.0	256.9	259.7	262.4	269.4	280.0	294.0	308.7	322.0
Domestic credit (as % of GDP)	34.6	30.0	29.3	32.5	27.1	23.0	15.7	12.4	12.2	13.0	12.0	9.7	9.6	8.4	9.2
Credit to private sector(% of GDP)	13.9	14.0	9.7	10.8	9.7	6.7	3.1	3.5	4.3	4.7	4.6	4.9	6.0	7.6	9.0
Inflation rate	35.8	28.7	21.8	25.3	33.1	*28.4*	*21.0*	*16.1*	*12.8*	*7.9*	*5.9*	*5.1*	1.0	3.5	4.1
Exchange rate	195	219	298	405	510	575	580	612	665	745	800	876	967	1038	1089
Population	25.5	26.3	27.1	27.9	28.8	29.6	30.5	31.3	32.1	32.9	33.7	34.4	35.2	35.9	36.6
Population growth rate	3.10	3.12	3.09	3.05	2.99	2.92	2.80	2.68	2.56	2.44	2.32	2.21	2.10	1.99	1.88

Uganda

Indicators	1990	1991	1992	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Narrow money, M1	85110	127666	206010.5	259395.5	354020.2	408700.7	450836	512532	612437.2	689357.7	805492.3	908796.4	1099443	1234914	1341238
Quasi money	19400	30837	57880	155490	209414	233302	315372	402455	512419	588010	703618	739401	961108	1193748	1356473
Broad money,M2	104510	158503	263890	414886	563434	642002	766208	914987	1124856	1277368	1509110	1648197	2060552	2428662	2697711
Broadmoney (as % of GDP)	6	7	8	9	11	11	12	13	14	15	16	16	18	19	19
Domestic Credit	*0*	*0*	*487344*	*468472*	*406249*	*234994*	*315325*	*435515*	569771	657223	1142747	1016622	1569574	1478200	1452762
Gross Domestic savings (Current $ mil)	25	23	12	36	173	425	278	587	351	440	463	367	298	418	540
Gross Domestic Savings (% of GDP)	1	1	0	1	4	7	5	9	5	7	8	6	5	7	8
Gross domestic investment(% of GDP)	13	15	16	15	15	16	17	17	16	19	19	18	19	20	21
GDP (Current $ Billions)	4.3	3.3	2.9	3.2	4.0	5.8	6.0	6.3	6.5	6.0	5.9	5.7	5.9	6.3	6.8
GDP growth	6.5	5.6	3.4	8.3	6.4	11.5	9.1	5.1	4.9	7.9	5.4	6.1	6.8	4.7	5.7
GDP per capita ($)	176.8	179.8	179.6	188.7	195.2	212.5	225.9	231.2	236.0	247.5	253.3	261.2	271.4	276.5	285.2
Domestic credit (as % of GDP)			17.8	12.1	9.2	4.4	5.2	6.6	7.6	8.1	12.8	10.2	15.3	12.5	11.0
Credit to private sector(% of GDP)			4.0	4.4	4.4	4.6	5.3	4.8	5.7	6.4	6.6	5.9	6.6	6.9	6.8
Inflation rate	33.1	28.1	52.4	6.1	9.7	8.6	7.2	6.9	0.0	6.4	2.8	2.0	-0.3	7.8	3.3
Exchange rate	429	734	1134	1195	979	969	1046	1083	1240	1455	1644	1756	1798	1964	1810
Population	*17.4*	*18.0*	*18.7*	*19.2*	*19.8*	*20.3*	*20.8*	*21.4*	*21.9*	*22.6*	*23.3*	*23.9*	*24.6*	*25.3*	*25.9*
Population growth rate	4.1	3.8	3.4	3.1	2.8	2.4	2.5	2.6	2.7	2.8	2.9	2.9	2.8	2.7	2.5

Money supply and domestic credit data are in millions of local currency
Source: World Bank's *World Development Indicators* database

On its part, Uganda's economy grew at an impressive rate that averaged about 7 percent per annum the period of ten years starting from 1990. The high rates of economic growth were due to good economic policies that led to increases in foreign direct investment and substantial donor support following the restoration of relative political and economic order. However, since 1999, Uganda's average annual rate of growth has started to slow down. In 2005, the most recent year for which data is available, growth was 5.6 percent, which is well below the rate achieved in Tanzania.

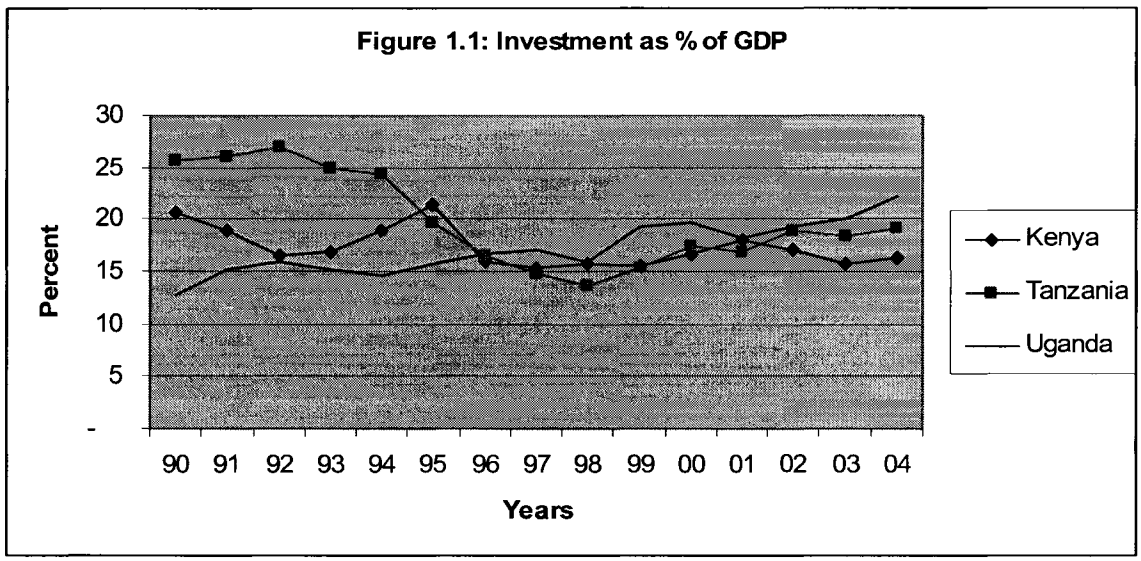
On the other hand, Kenya's economic performance since early 1990s has been comparatively poor. During 1990 – 2004, Kenya's real GDP grew at an annual average rate of 1.8 percent. This compares unfavorably with that of Uganda (6.5) and Tanzania (4.5) during the same period. According to IMF (2002), high real interest rates combined with high transaction costs and high business uncertainty resulted to the slow output growth in Kenya. Also the prevalence of high rates of corruption, has deeply affected Kenya's credibility in the international community, as reflected in the withdraw of the IMF and World Bank support for the economy.

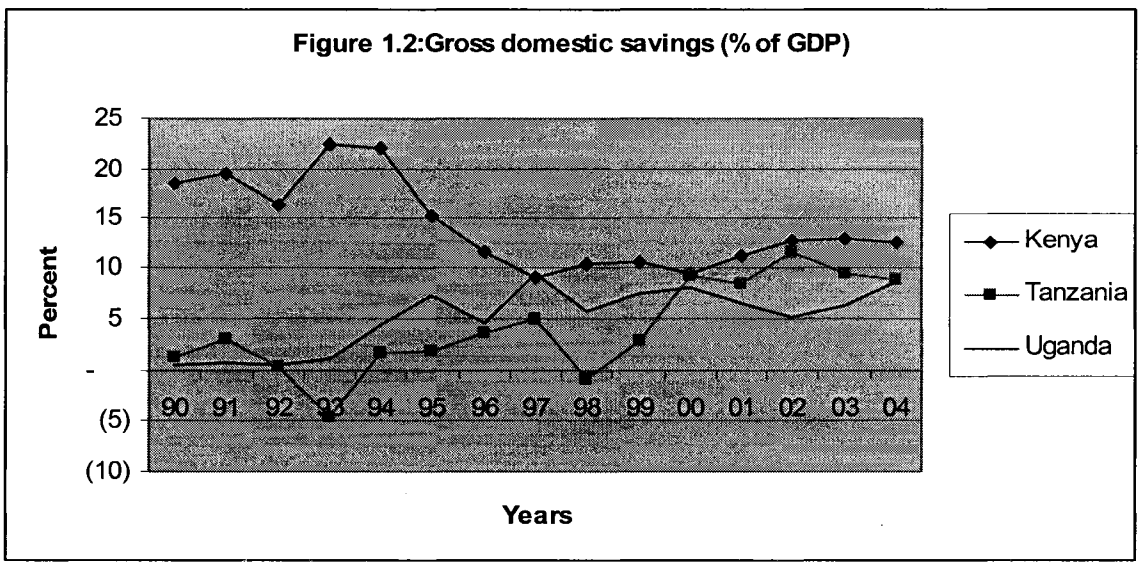
Table 1.1 also shows that, money supply as measured by various monetary aggregates (M1, quasi money and M2), has shown a phenomenal growth in all three countries. For instance M2 in nominal terms increased twenty-five, seventeen and nine fold in Uganda, Tanzania and Kenya respectively during the period from 1990 to 2004. Over the same period however, the ratio of M2 to GDP (a measure that has been widely used in the literature as a monetization variable) showed different trends for the three countries. For

Uganda, the ratio of M2 to GDP increased from 6 percent in 1990 to 19 percent in 2004, while that of Tanzania rose from 17 percent to 22 percent for the same period with some fluctuations. Kenya on the other hand, experienced a rapid increase in M2 to GDP ratio during the period 1990 to 1998 going up from 27 percent to 44 percent. But since 1998 this ratio has been steadily declining, suggesting that the size of financial sector is growing slower than the real sector. However, as the table show, Kenya's financial sector is significantly larger than that of Tanzania and Uganda.

Although as shown above, economic growth has been impressive in Uganda and Tanzania in recent years and that of Kenya continuous to improve, much faster and sustainable growth is required in the region to absorb the rapidly rising labor force and materially improve living conditions. There is a need to raise average real GDP growth rates to above 7 percent a year on a sustainable basis in order to achieve the Millennium Development Goals. Other things being equal, attaining such high growth rates over long periods of time would imply investment-to-GDP ratios in excess of 25 percent, similar to those achieved in the periods of sustained high growth in Asian countries. It will also require substantial improvements in capital productivity, particularly in Kenya given its recent record of very low growth. The ratio of investment to GDP in the region is currently highest in Uganda (22 percent) and lower in Tanzania (19 percent) and Kenya (16 percent) (see figure 1.1). This calls for higher rates of domestic savings in order to mobilize idle resources and improve capital accumulation. Unfortunately, the gross domestic savings in the region is extremely low, standing on average at 10 percent of GDP in 2004, putting into question the region's ability to maintain high growth rates on

sustainable basis. Given the declining international assistance for financing investment, the region needs to achieve substantially higher rates of domestic savings in order to finance the required increases in investment thereby accelerating its growth and development.





However, attaining high rates of domestic savings require well developed and efficient financial sectors. A well-developed financial sector enhances financial intermediation, which is the process of pulling idle financial resources from surplus economic entities in to productive investment opportunities. This in turn promotes economic growth and increases the welfare of individual citizens.

1.3 The Financial Sector and Economic Growth

Many studies find a close link between financial sector development and economic growth and conclude that policies affecting the financial sector have substantial effects on the pattern of economic development (King and Levine, 1993). A study by the World Bank (1994), for example, estimates that policies that would raise the M2/GDP ratio by 10% would increase the long-term per capita growth rate by 0.2 – 0.4 percentage points.

Recently there have been a growing number of empirical studies on the factors that influence economic growth and policies that would reduce poverty and promote economic development in the Sub-Sahara African region. While the role of factors such as foreign direct investment, international trade, fiscal policy, labor force, etc., have received considerable attention in empirical work[1], the role of financial sector development on economic growth in Africa, and in particular, East African region, has largely been ignored. The purpose of this dissertation is to determine the relationship between financial sector development and economic growth in the EAC member states.

Measuring financial sector development constitutes a challenge to researchers in their efforts to assess the impact of financial sector development on real economic activity.

[1] See for example Nnadozie E. (2003), Ibrahim A. and Ndulu B. (1995),

Traditional measures of financial sector development usually used in empirical studies can be classified roughly in to two broad categories[2]. The first refers to the presence and diffusion of the banking system: here the most commonly used indicators are the ratio between liquid liabilities of the banking system and GDP. The second group of variables measures the amount of financing intermediated by banks. Among these variables are the ratio between domestic credit and GDP, the share of credit granted to the private sector (i.e. credit to the private sector as a ratio of total credit) and the credit granted to the private sector in ratio to GDP.

Riccardo et al. (2000), argues that these measures suffer from two major shortcomings. Firstly, there is the problem of causality. The growth of the banking system and the amount of credit disbursed are closely influenced by the level of economic development. So it is perfectly possible that financial systems develop in response to higher economic growth. Secondly, these two types of measures have the further shortcoming that they essentially concentrate on the role of banks in stimulating capital accumulation. Yet, as Stiglitz and Weiss (1988) argue, the specific role performed by banks in the economic system is not to intermediate savings, but rather to certify the quality of borrowers. They argue that banks are essential to economic development in that they are a crucial device for the selection of entrepreneurs and the allocation of financial resources. However, the existing literature has focused on the impact of increased volume of financial services (both bank–based and market-based) on the economic growth. The importance of the quality of financial services has been ignored. This study explores the importance of the quality of financial services to economic growth by studying the relationship between

[2] See Riccardo L. et al, (2000), Nnadozie E. (2003)

bank efficiency and economic growth in the economies of the three East African Community countries. However, the use of bank efficiency in this study is not taken as a substitute for other measures of financial sector development such as liquid assets and credit allocation. Bank efficiency is, instead, considered as a different dimension of financial sector that can be associated with performance of various macroeconomic variables such as economic growth.

The use of bank efficiency has two important advantages. First, the efficiency of banks is a measure that suffers less from the problem of causality between finance and growth. The ability to use inputs correctly is certainly less dependent on the growth rate of the economy than the amount of bank credit. Secondly, bank efficiency seems better able to capture the allocative function of banks in that the ability to use the available technology and to combine the inputs in the production process optimally can be considered a necessary condition for the correct allocation of resources.

1.4 Statement of the Problem

Efficiency is a fundamental concept in Neo-classical theory. At a more aggregate level, efficiency is related to the problem of optimal allocation of resources. In a competitive environment, the existence of inefficiency at the firm level (in the long run) is difficult to justify. Inefficient firms are expected to be driven out of the market by more efficient ones and, in the long run, only the efficient ones will remain. Thus, for the decision maker of any firm, it is important to know the relative level of efficiency with respect to other firms in the market and to the frontier of possibilities. For the economy as a whole, the optimal allocation of resources is an important factor for the determination of growth. If scarce resources are not used for their most productive ends, it is clear that an economy will grow at a rate less than its potential capacity.

The recent formation of the East African Community and the proposed establishment of East African Federation, have made banks in the region to operate in an increasingly competitive environment. This trend is expected to continue; as interregional banking restrictions fall, the number of non-bank competitors increases and competition from foreign banks picks up - partly in response to the general globalization of markets. How the increased competitive pressure will affect banks in the region depends in part on how efficiently they are run. Their success will depend on their ability to adopt and operate efficiently in the new environment. The most efficient banks should drive inefficient banks out of the market. As such, information regarding how efficient banks are in one country as compared to their counterparts in other countries is a matter of great importance on several accounts: First, at the firm level, inefficiency has consequences

not only for the firms' profitability, but also for its very survival in a competitive economy. A firm that is not efficient may be forced out of the market by more efficient ones. Second, from a policy perspective, inefficiency has important implications as well. Basically, it indicates that there is a waste in the economy. Most likely, improvements in these inefficiencies would induce overall gains in productivity in these firms and in the whole economy thereby potentially generating higher growth rates.

Inefficiency problems are especially important to address in developing countries that are struggling to achieve higher rates of economic growth. In many cases, their domestic economies suffer from many problems such as market imperfections that make it possible for inefficient firms to survive. The measure of degree of these inefficiencies and the determination of their causes are the first step toward addressing and solving them. This is especially important in the financial sector due to the crucial role it plays in facilitating transactions in the market and improving the allocation of resources.

Most of the empirical studies on bank efficiency have focused on the U.S.A. and other developed countries with little attention to developing countries. Furthermore, while there are a few studies on international comparisons of bank efficiency in developed countries, comparisons of bank efficiency across developing countries are virtually absent in the literature. This study attempts to fill these gaps by empirically investigating and comparing bank efficiencies across the three countries of Kenya, Tanzania and Uganda, which form the East African Community (EAC).

The issue of bank efficiency is, however, secondary if the efficiency of the banking sector does not help in generating faster economic growth. Despite the growing theoretical and empirical evidence on the importance of a well functioning financial system to a country's economic growth, there is no study, to our knowledge, that empirically tests the relationship between the efficiency of the financial system and economic growth in the East African region. This study is therefore, a modest attempt to rectify this gap in the literature.

1.5 Research Questions

The broad objective of the study is to investigate the role of financial systems in the economic growth of the East African region. The study therefore addresses the following main research questions: First, do the commercial banks in the EAC region operate efficiently given their production frontier? Second, if they don't, then are there significant differences in banking sector efficiencies across the three countries? Third, is there any significant relationship between bank efficiency and economic growth? Finally, if such relationship exists, are the channels of transmission to economic growth associated with capital accumulation and/or with capital productivity? This dissertation attempts to answer these questions and to suggest appropriate policy responses. These questions are of obvious policy relevance to the region because, if causality is found to exist between financial sector and growth, that would heighten the urgency attached to policy reforms designed to promote financial sector development. It would also help policy makers in designing reforms that promote a growth-enhancing financial sector.

1.6 The Significance of the Study

The EAC member states are currently working towards the establishment of a common currency among the three countries. In these efforts, they plan to put in place common institutions such as a common central bank, a common financial sector supervisory agency, and also harmonize the conduct of their monetary policies. This move is expected *inter alia* to intensify a competitive pressure on the banking sector in the region as a result of a removal of interregional banking restrictions. In this regard, the importance of this study is two fold: First, from a policy perspective, understanding how efficiently banks in one country are operating compared to those in other countries can provide a crucial input in to assessing future course of action. Second, at the firm level, inefficiency has consequences not only for the firm's profitability but also for its very survival in such a competitive market. An empirical study of the region's commercial bank efficiency is therefore important, not only to the policy makers, but also to the bank managers as well as to the depositors.

Also this study is intended to provide further contribution to the finance - growth literature in several ways: First, we focus in East Africa, a region that has not received much attention on this kind of studies. It is therefore expected that the study will contribute significantly to the African literature on sources of economic growth. Policy implications derived from this study will aid African policy makers in understanding the link between the banking sector and economic growth in the region. Second, we intend to make a methodological contribution to the empirical analysis of the relationship between the financial sector and economic growth by focusing on the dimension of

financial system that is typically not examined in this line of research – the relative efficiency of commercial banks. The study therefore, seeks to eventually offer an alternative empirical framework for studying the link between financial sector development and economic growth.

1.7 Hypotheses to be tested

Three sets of hypotheses will be tested in this study. The first set includes three main hypotheses which relate financial sector to economic growth. The second group of hypotheses will consist of three secondary hypotheses which deal with control variables included in the growth model. The last set will include two hypotheses which tests the intermediary variables through which financial sector impact on economic growth. We formulate a null hypothesis (HO) against an alternative hypothesis (HA) as follows:

Group I: Financial sector and economic growth

HO1 "Commercial bank efficiency does not positively and significantly affect economic growth"

HA1 "Commercial bank efficiency positively and significantly affects economic growth"

Financial sector not only facilitate savings, and efficient allocation of these savings to borrowers, but also it facilitates transformation and distribution of risks and maturities over time. In this regard, the financial sector mitigates the tension between servers' preference for liquidity and entrepreneurs' need for long term financing. Financial sector

also ensures the efficient allocation of the resources through evaluating and monitoring of the borrowers. Therefore, banks performance has substantial influence on the overall efficiency of domestic resource mobilization and allocation, and hence the performance of the economy. Better functioning banks improve resources allocation and accelerate capital productivity growth with positive repercussions for long run growth. We therefore expect the sign of the coefficient of financial sector efficiency variable to be positive and statistically significant in favor of the positive correlation between bank efficiency and economic growth.

HO2 "The ratio of credit to the private sector to GDP does not directly and positively contribute to economic growth".

HA2 "The ratio of credit to the private sector to GDP directly and positively contributes to economic growth".

The amount of credit allocated to the private sector, as opposed to the public sector, is expected to exert a positive impact to the economic growth. Levine (1997) argues that financial systems that allocate more credit to private firms are more engaged in research, exerting corporate control, providing risk management services, mobilizing savings and facilitating transactions than financial systems that simply funnel credit to the government or state-owned enterprises. The coefficient of credit variable is therefore expected to have a positive sign, to indicate that credit allocated to the private sector promotes economic growth.

HO3: "The interaction between the volume of credit extended to the private sector by commercial banks and the efficiency of those banks is not directly and positively related to the growth rate of real GDP".

HA3: "The interaction between the volume of credit extended to the private sector by commercial banks and the efficiency of those banks is directly and positively related to the growth rate of real GDP".

The assumption underlying this hypothesis is that, growth in the size of the credit to the private sector may not have favourable economic effects, if such credit is provided by poorly managed commercial banks. It seems more likely that, credit extended to the private sector by relatively efficient banks will be more effective in promoting economic growth. The coefficient of interaction term is therefore expected to bear a positive sign to reflect the fact that the marginal benefit of banks' credit to the private sector is greater; the more efficient are the banks.

Group II: Control variables

HO4: "Inflation rate does not negatively and robustly affect economic growth".

HA4: "Inflation rate negatively and robustly affect economic growth".

Higher inflation causes depreciation of real money balances, real return of financial assets and capital. A high rate of inflation is associated with high risks and uncertainty that discourages and hence retard economic growth. On the other hand, low inflation rate

promotes stable financial environment, necessary for economic growth. Therefore, we expect the coefficient of inflation rate to have a negative sign indicating that inflation is harmful to the economy.

HO5: "Population growth is not directly and positively related to the real GDP growth rate."

HO5: "Population growth is directly and positively related to the real GDP growth rate."

Real GDP growth rate is directly and positively related to the flow of human capital measure – population growth. Human capital plays a special role in economic development. Human capital is the key input to the research sector, which generates new products of ideas that underlie technological progress. An educated population is not only more productive, but also provides a large tax base and increased political involvement, all of which are essential to economic growth. Therefore, the coefficient of human capital is expected to have a positive sign indicating that an increase in the quality of human capital will encourage growth.

HO6: The average growth rate of trade to GDP ratio does not positively and significantly affect the rate of economic growth.

HA6: The average growth rate of trade to GDP ratio positively and significantly affects the rate of economic growth

There are various reasons why trade might promote economic growth. Export may positively affect growth by increasing the market for domestic products. Imports may also promote growth if the imports are associated with capital goods. Furthermore, trade promotes competition there by reducing possible monopolies and encourage greater efficiency in the allocation of scarce resources. The coefficient of the trade variable is therefore, anticipated to be positive and statistically significant.

Group III: Intermediary variables

HO7: "Commercial banks' efficiency does not positively and robustly affect capital productivity"

HO7: "Commercial banks' efficiency positively and robustly affects capital productivity"

Efficient financial institutions are better suited to identify and allocate financial resources to potentially successful projects and therefore ensure that server's funds are used more productively. Therefore, improved financial sector efficiency is expected to improve productivity growth, thus potentially sustaining long-run growth.

HO8: "Commercial banks' efficiency is not directly and positively related to the volume of savings"

HA8: "Commercial banks' efficiency is directly and positively related to the volume of savings"

Efficient financial sector encourages economic units to hold more financial assets. A greater volume of financial assets in the hands of the public is associated with higher levels of savings, investment and economic growth.

1.8 Organization of the Study

The rest of this study is organized as follows: Chapter two presents a descriptive analysis of the trends in the financial sectors of the East African Sub-region. Chapter three reviews the relevant literature and presents the major gaps in early work that are addressed by the present study. Chapter four discusses the data and the methodology of the study. Chapter five analyzes the empirical results. Finally chapter six provides concluding remarks and policy recommendations based on empirical findings. The chapter also highlights on areas for future research.

CHAPTER TWO

An Overview of Financial Sectors in the East African Region

2.1 Financial Sectors before Reforms

When the three East African countries gained their political independence in early 1960s, they all inherited financial systems dominated by foreign commercial banks. The financial sectors in these countries were integrated through the East African Currency Board (EACB) which provided for and controlled the supply of currency to the three states. However, the EACB was dissolved a few years after political independence of the three nations and the national central banks were established to take up its functions. The central bank of Uganda was established under the Bank of Uganda Act on 1966 while that of Tanzania and Kenya were established by the Acts of Parliament in June and May of the same year, respectively. After the formation of independent central banks, the three nations adopted somehow different approaches towards developing their financial sectors. Tanzania adopted a socialist ideology that favored central planning as opposed to market forces. Following this ideology, the entire financial system was placed under state ownership and control. In 1967, all 12 private commercial banks, which were operating in the country, were nationalized and consolidated to form a new state owned commercial bank – National Bank of Commerce (NBC). There were also two more state owned commercial banks, namely, People's Bank of Zanzibar (PBZ) and Cooperative and Rural Development Bank (CRDB). Until 1991, the financial system in Tanzania was extremely narrow comprising of the central bank at the apex, the three commercial

banks, two insurance companies and two social security institutions. However, the national bank of commerce (NBC) was the only commercial bank of any significance, with about 90 percent of all deposit liabilities of deposit–taking institutions.

Unlike Tanzania, Kenya adopted a more liberal financial sector policy, where private banks, both local and foreign, were allowed to operate along with government owned banks. Kenyan government encouraged local participation in the banking sector through issuing new banking licenses to indigenous, but also foreign banks were allowed to operate and they accounted for substantial part of the financial system. The government also actively engaged in the financial sector by establishing several financial institutions, including the two major commercial banks – Kenya Commercial Bank and National Bank of Kenya. The Kenyan financial system expanded very rapidly during 1970s and 1980s. The number of commercial banks increased from 10 foreign-owned commercial banks at independence, to 23 in 1985, of which, 15 were foreign owned, 6 were locally owned private banks and three were state banks. During the same period, the number of non bank financial institutions (NBFIs) increased from 9 to 54 (See Eno L. Inanga and David B. 2003).

Ugandan financial sector during the early years of independence was more similar to that of Tanzania as compared to that of Kenya. However, due to civil disturbances in Uganda during most of 1970s and 1980s, financial services became concentrated only in few commercial banks in the capital of the country. For example, until late 1980s, the two

largest state owned commercial banks, Uganda Commercial Bank and Cooperative Bank, controlled about 70 percent of the banking activities (Senbet W. and Otchere I, 2005)

By the early 1990s, Kenyan financial system was relatively well developed and diversified when compared with Uganda and Tanzania. However, the financial sectors in the region had many similarities, partly as a result of the inward-looking economic development strategies, implemented by the three countries. In all three countries, the financial sectors consisted of mainly commercial banks and a few specialized financial institutions. In Tanzania and Uganda, capital markets were nonexistent given the predominant role of state ownership and the absence of legal basis for stock markets to operate. Stock markets existed in Kenya, but it was relatively inactive.

The financial systems of all three countries were tightly controlled and government interference with day-to-day management and operations of financial institutions was a common practice in all three countries. Except for Kenya, where foreign and private bank entry was allowed, in Uganda and Tanzania, private banks entry was highly restricted. In all three countries interest rates were set administratively and were negative in real terms during most of the 1970s and 1980s. Credit allocation was also administered by the governments and was directed to priority sectors. Foreign exchange was highly restricted in all the three countries, albeit to a different degree. In Tanzania, for example, foreign exchange receipts had to be surrendered to the central bank which retained a virtual monopoly over the holding of the foreign exchange. Also in Uganda, coffee exporters were required to surrender their proceeds to the bank of Uganda.

Monetary policy in all three countries was primarily conducted through direct instruments. The banking systems favored public sectors access to banking resources, which crowded out private sector borrowing.

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Government interference with commercial banks credit allocation decisions undermined the financial position of the commercial banks and adversely affected the quality of their loans portfolios. The directed credits to priority sectors often became non-performing loans. Also the tendency of governments in the region to finance public sector deficits through money creation resulted to higher rates of inflation and negative real interest rates on deposits. In all three countries, the development of banking supervision and prudential regulation was limited partly because the central banks' direct control over the direction and volume of credit limited the scope for prudential banking supervision.

Faced with increasing economic difficulties in the mid-1980s, and also influenced by the worldwide trend toward economic liberalization and deregulation, the three countries embarked on wide ranging economic reform programs that included a liberalization of financial sectors. Financial sector reforms were seen as a means to improve efficiency of financial resources mobilization and allocation so as to stimulate economic growth.

2.2 Financial Sector Reforms

Financial sector reforms in the region and elsewhere in Africa have mainly been motivated by the financial repression[3] paradigm promoted by McKinnon (1973) and Shaw (1973) who emphasized the role of government failures in financial sector. They pointed out that misguided financial sector policies have damaged the economies of many developing countries by reducing savings and encouraging investment in inefficient and unproductive activities. In particular they argue that, an administratively fixed nominal interest rate that holds the real rate below its equilibrium level depresses returns to savers, and so discourages savings. Also interest rate ceilings discourage financial institutions from charging risk premiums, which may ration out a large number of potential borrowers with high-return projects. Furthermore, they argue that selective or directed credit associated with financial repression will result in higher loan defaults, reduce flexibility and increase the fragility of the banking system. Financial repression was common in the East African financial sectors before reforms. The financial systems in the region were characterized by low or negative real interest rates, high reserve requirements, interest rate ceilings, directed credit allocations to priority sectors and heavily government ownership and management.

The financial sector reforms in the three countries of Kenya, Uganda and Tanzania, had similar objectives and instruments. Key objectives of reforms in these countries were to reduce direct government intervention and strengthen the role of market forces in the allocation of financial resources, improve the capacity of financial institutions to mobilize

[3] Financial repression refers to the distortion of domestic financial markets through measures such as ceilings on interest rates and credit expansion, selective allocation of credit, high reserve requirements, and restrictions on entry in to the banking industry.

domestic savings, enhance the effectiveness of monetary policy instruments, promote competitions among banks, and strengthen their financial soundness. Some of the major reform initiatives in the last decade that have changed the face of the region's banking and financial sectors are summarized below.

2.2.1 Liberalization of Interest Rates and Credit Allocation

Gradual liberalization of interest rates was important initial step in the reform of the financial sector in each of the three countries. In Kenya, moves to liberalize interest rates began in 1989 when the interest rate ceilings on long term bank loans and non-bank financial institutions (NBFI) lending were unified while the ceilings on deposit rates for both commercial banks and NBFI were progressively raised. In 1990, financial institutions were allowed to include all lending related charges and fees so that the effective rates on loans could exceed the stipulated ceilings. In November of the same year, Treasury bill rates were fully liberalized. Both savings and lending interest rates were finally liberalized in July, 1991.

In Uganda, administered credits and interest rates were steadily removed starting in April of 1992 when auction-based Treasury bill market was introduced. In November of the same year, interest rates were partially liberalized by linking deposit and lending rates to the average Treasury bill yield on four preceding Treasury bill auctions. In July of 1994, all interest rates were fully liberalized. In Tanzania, interest rate ceilings were removed in 1993 and were replaced by a new system in which interest rate were determined by a more competitive Treasury bill market. Interest rates were fully liberalized in 1994.

In all three countries, the elimination of administrative credit allocation was an important component of the financial sector reforms. For example, in Kenya, credit guidelines which were in existence since 1975 and in favor of agricultural sector were abolished in December 1993 while in Uganda, directed and subsidized lending to priority sectors was phased out in 1992. Also in Tanzania where credit policy favored cooperative unions and government owned entities, controls and credit rationing were removed in 1994 and banks were expected to extend loans on commercial basis.

2.2.2 Regulation and Supervision

Strengthening prudential regulation and bank supervision was critical for the success of the liberalization and deregulation of financial activities, as market participants were allowed to take greater risks. In all three counties, new banking laws were enacted with the objective of granting adequate powers to the central banks and strengthening bank regulations in line with international standards. Bank supervision was also enhanced significantly during the reform period in all three countries. In Tanzania, the Banking and Financial Act was passed in 1991 to replace the Banking Ordinance which was passed in 1960 by the colonial government. Likewise, in Uganda, the Financial Institutions Statute (FIS) was enacted in May 1993 replacing the Banking Act of 1969. In Kenya, Banking Act was enacted in 1989 and it replaced the Banking Act passed 1969. The Kenyan banking Act has been revised twice since its enactment, first in 1991 and second in 1995. In all three countries, the new laws laid down legal frameworks for establishing and operating banking business in the now liberalized economies. The new

laws granted central banks the legal powers to enforce prudential regulations and supervision within financial institutions in their respective countries. In Uganda and Tanzania, the central banks were granted sole powers to issue licenses to banks and other financial institutions while in Kenya such powers were vested with the Finance Minister. Under the new banking laws, banks were required to have their annual reports certified by external auditors and be submitted to the central banks. Also the laws explicitly defined the minimum capital requirements for various types of financial institutions and for bank ownership. For example, in Tanzania the minimum paid-up capital for commercial banks was fixed at 1 billion Tanzanian shillings. Other financial institutions were required to maintain a minimum paid-up capital of 500 million Tanzania shillings. In Uganda, for foreign banks the minimum paid-up capital required were set at 1 billion Ugandan shillings while for local banks, the required amount was 500 million Ugandan shillings. In Kenya the minimum capital requirements for banks was set at Kshs.15million if incorporated in Kenya and Kshs.150million if incorporated outside Kenya.

The central banks' examination and supervision functions have also been upgraded to enable the Banks to carry out systematic on-site and off-site analysis of banks' performance and financial conditions. The laws also empower central banks to assess penalties against non-compliant institutions. In all three countries, financial institutions are required under the new laws, to diversify in order to spread risk and are not allowed to lend more than a certain percentage of their core capital to individual borrowers, shareholders or insiders. This measure was aimed at ensuring that banks extend credits in accordance with sound banking principles and to reduce the risk of bad debts. The new

laws also stipulate the prudential guidelines for the management of assets, provision for loan losses and the accrual of interests.

2.2.3 Deposit Protection Schemes

Another important reform measures was the introduction of deposit protection schemes by all three countries. In Kenya, Deposit Protection Fund Board (DPFB) was established in 1986 under section 36 of the Banking Act, while in Tanzania, Deposit Insurance Board (DIB) was established in 1995 under section 24(1) of the Banking and Financial Institutions Act. The Deposit Insurance Fund (DIF) in Uganda was established in 1994 as provided in the Financial Institution Statute of 1993. The purpose of establishing deposit insurance schemes in all three countries was; first to protect small depositors in case of bank failure and second to maintain confidence and stability in the financial systems. In Tanzania and Kenya, the schemes operate independently from the central banks and are managed by independent board of directors, chaired by the central bank governors. In the case of Uganda, the insurance scheme is managed and controlled by the central bank. In all three countries, membership to the deposit insurance schemes is compulsory to all deposit taking financial institutions, and the terms and conditions of the schemes are explicitly stated in their respective statutes.

In terms of coverage, all three countries provide limited coverage, where deposit insurance is restricted up to a certain maximum amount. As shown in Table 2.1 the maximum amount of insurance protection provided to individual depositors by the schemes vary across the three countries. While Kenya provide a coverage of up to

100,000 Kenya shilling (approximately USD 1,263), Tanzania and Uganda provide a maximum coverage of up to 500,000 Tanzania shillings (approximately USD 500) and 3 million Ugandan shillings (approximately USD 1,660) respectively. In all three countries, the application of the limited coverage is on the basis of *per depositor* as opposed to *per deposit*[4]. Kenyan scheme covers all types of deposits while in Uganda and Tanzania, the deposit insurance systems do not cover inter-bank deposits and deposits denominated in foreign currencies.

The main source of income for the three deposit protection schemes is annual insurance premium contributions from member institutions. As Table 2.1 shows, Uganda charges a higher premium of 0.2 percent of the average total deposits over a period of one year, while in Kenya and Tanzania; the current premiums are 0.15 and 0.1 percent of the average total deposits respectively. Another source of income is the earnings from the investment of the schemes' resources, mainly in the government securities. The Ugandan and Tanzanian schemes received initial grants from their respective governments.

[4] Application of coverage per deposit allows a depositor to gain unlimited coverage by diversifying his/her portfolio among different accounts in the same bank. Per depositor application of limited coverage limits coverage to up to certain maximum amount in a bank regardless of how many accounts the depositor has.

Table 2.1: Comparison of Deposit insurance Schemes in East Africa

Country	Year of establishment	Types of deposits covered	Coverage (National currency)	Basis	Sources of income	Premium
Kenya	1986	All	100,000	Per depositor	-Premiums -Investments	0.15%
Tanzania	1995	All except foreign and inter-bank	500,000	Per depositor	-Premiums -Investments	0.1%
Uganda	1994	All except foreign and inter-bank	3 Million	Per depositor	-Premiums -Investments -Government	0.2%

Source: Central Bank of Kenya, bank of Uganda and Bank of Tanzania

2.2.4 Other Reforms

In all three countries, the move away from quantity rationing and direct controls required efforts to develop indirect and market-based instruments of monetary policy. As direct and discretionary forms of credit control were removed, the monetary authorities started to manage liquidity through a more active use of reserve requirements and a more market based allocation of refinancing. This was done mainly through open market operations (OMO), regular auctions of repurchase agreements, and foreign exchange market operations. In Kenya, government took measures to remove institutional constraints in the operation of Treasury bill and bond markets, including the use of auction and issue of a broader range of Treasury bills. In Uganda Treasury bill auction was established in 1992 to facilitate monetary policy, and in the following year, Treasury bills of 180 and 270 days maturity were introduced. Also the central bank of Uganda intensified enforcement of observance of statutory reserve requirements by commercial banks. In Tanzania, indirect instruments of monetary policy were introduced in 1993 following the adoption of a market-based system of economic management.

In the course of financial sector reforms, new instruments and markets were also introduced in all countries, particularly, Inter-bank Foreign Exchange Market (IFEM) and stock markets. Introduction of Inter-bank Foreign Exchange Markets (IFEM) was an important move towards market-based allocation of foreign exchange with the objective of replacing former regimes in which foreign exchange was administratively allocated. The market-based exchange rate regimes were expected to provide a more efficient and reliable mechanism for the allocation of foreign exchange resources. The Inter-bank Foreign Exchange Markets were introduced in Kenya and Uganda in 1993, while in Tanzania such a system was adopted in June 1994. However, the central banks in all three countries intervenes the foreign exchange markets in order to smoothen out wide fluctuations and therefore, ensure exchange rate stability.

Development of capital markets was an important building block in financial sector reforms in all three countries. As mentioned earlier, stock exchange market existed in Kenya since 1954, but its scope of operation was very limited. A regulatory board, Capital Market Authority (CMA) was formed in 1990 to assist in the creation of an environment conducive to the growth and development of the country's capital markets. In 1991, the Nairobi Stock Exchange (NSE) was registered under the Companies Act and phased out the "Call Over" trading system in favor of the floor-based "Open Outcry System". Subsequently the stock exchange embarked on an extensive modernization exercise, including a modern information centre, computerization and electronic trading. As part of reforms, the Kenyan government also put in place several policy measures to encourage investments in the Nairobi Stock exchange. Such measures include a

favorable tax regime such as exemption of listed securities from stamp duty, capital gains tax and value added tax. Withholding tax on dividends was put as low as 5% for residents and 10% for non-residents (Ngugi, 2001). The above regulatory and technical improvements, along with the acceleration of privatization programs, have helped revitalize the stock exchange market in Kenya, which is currently the fourth largest Stock exchange in the Sub-Saharan Africa.

In Tanzania and Uganda, capital markets were non-existence before the financial sector reforms. The establishment of Capita Market Authorities in 1994 and 1996 in Tanzania and Uganda respectively, marked a milestone in efforts by the two countries to create enabling conditions for establishment and regulation of capital markets. Consequently, the Ugandan Securities Exchange (USE) was launched in June 1997 and opened its doors to trading in January 1998. On the other hand, in Tanzania, the stock exchange, Dar es Salaam Stock Exchange (DSE) was launched in 1996 and began its first day of operation in April 1998.

As may be seen from Table 2.2, Ugandan and Tanzanian markets are still in their infancy, with a limited number of listed companies and low capitalization. Overall, the stock markets in the three East African countries are highly illiquid with very low trading and turnover ratios. This is no exemption even for Kenyan market which has existed since 1954. Low liquidity of stock markets has important implications for real economic activity. Low liquidity implies limited opportunities for the transformation of illiquid assets in to liquid assets. According to Nnadozie, 2003, it is the stock market liquidity,

more than the size of the market that plays the important role in facilitating long-term investment.

Table 2.2 Stock market indicators for Tanzania, Kenya and Uganda: 1998-2004

	Kenya				Tanzania				Uganda			
	Number of listed companies	Market capitalization[5]		Liquidity: (Turnover ratio[6])	Number of listed companies	Market capitalization		Liquidity: (Turnover ratio)	Number of listed companies	Market capitalization		Liquidity: (Turnover ratio)
		% of GDP	Volume: (US$ Million)			% of GDP	Volume: (US$ Million)			% of GDP	Volume: (US$ Million)	
1998	58	18	2,020	0.3	2	2.82	236					
1999	57	13	1,410	0.3	3	2.10	181	3.9				
2000	57	12	1,280	3.6	4	2.57	233	17.2	2		37	1.9
2001	57	9	1,050	3.4	4	4.22	398	2.0	2	0.6	34	
2002	57	12	1,420	3.8	5	5.82	695	2.7	3	0.83	52	
2003	51	29	4,178	7.4	6	6.40	398		3	0.76	36	
2004	47	25	3,891	8.0	7	6.17	670	2.5	5	1.4	96	

Source: World Bank's World Development Indicators Database

[5] Market capitalization (also known as market value) is the share price times the number of shares outstanding.
[6] Turnover ratio is the total value of shares traded during the period divided by the average market capitalization for the period

Another crucial component of the reforms was the liberalization of banking industry to allow private and foreign banks entry. This was particularly the case in Tanzania and Uganda where foreign banks were not allowed. In Kenya, foreign banks were not banned after independence, and so they continued to dominate the banking system. Although their dominancy has been gradually eroded, they still account for substantial part of the banking system. In Tanzania, at the start of financial sector reforms, there were only three state owned banks[7]. In efforts to promote competition, a new banking and financial Institutions Act was passed in the second half of 1991 which allowed the entry of foreign banks in the country. Since then, the number of private banks (both domestic and foreign owned), has increased steadily. By the end of 2001, the total number of banks had reached 17 and by 2004 the number had reached 22, most of which are foreign owned. In Uganda, bank licensing was liberalized in 1992, and in the same year, two commercial banks, Greeland bank and Sembule bank (now Allied bank) were licensed. The number of banks increased form 9 in 1992 to 20 in 1996. However, in 1998 Uganda went through a financial crisis in which several banks closed down. This reduced the number of banks from 20 in 1996 to 17 in 1999 and by the end of 2004 the total number of banks in the country was 15.

The rationale for liberalizing entry in the banking sector was to promote competition and therefore efficiency in the banking system. The liberalization of the banking sector and the subsequent enactment of the new banking laws in the East African countries, appear to have encouraged the emergence of new financial institutions which added depth and

[7] Prior to 1967, branches of foreign banks dominated the banking sector in Tanzania. The presence of foreign banks ceased in 1967 following the government's decision to nationalize all of them and formation of few state owned banks, which continued to dominate the banking system.

diversity to the financial systems in the region. In this regard, several banks and non-bank financial institutions have been established by private entrepreneurs, both local and foreigners. By and large, the establishment of these financial institutions has meant that financial services can be extended beyond the range typically provided by the financial institutions before reforms. Although this has the potential to increase competition and enhance the efficiency in financial intermediation, the increase in the number of banks has not translated in to substantial increase in competition as most of the new banks operate in very limited geographical areas, mostly in urban areas. As a result, interest rates spreads in all three countries have remained relatively high as shown in Table 2.3

2.3 Recent Trends in the Financial Intermediation

As figure 2.1 and 2.2 show, despite the recent decline, the Kenyan banking system continues to play a considerably larger role in the economy than the banking systems in Tanzania and Uganda. In Kenya, the ratio of broad money to GDP (a measure of monetization of the economy) grew through 1997 to almost 45 percent before declining back to 35 percent in recent years. In Tanzania, the broad money to GDP declined steadily in 1995 through 1999 but since then the trend has gradually improved standing at about 22 percent in 2004. Uganda has the lowest ratio of broad money to GDP among the three countries. However, following financial sector reforms in early 1990s combined with gradual recovery from civil disturbances of 1970s and 80s, Uganda has maintained a positive growth in the ratio of broad money to GDP throughout 1990s and early 2000s, almost entirely closing the gap between Uganda and Tanzania.

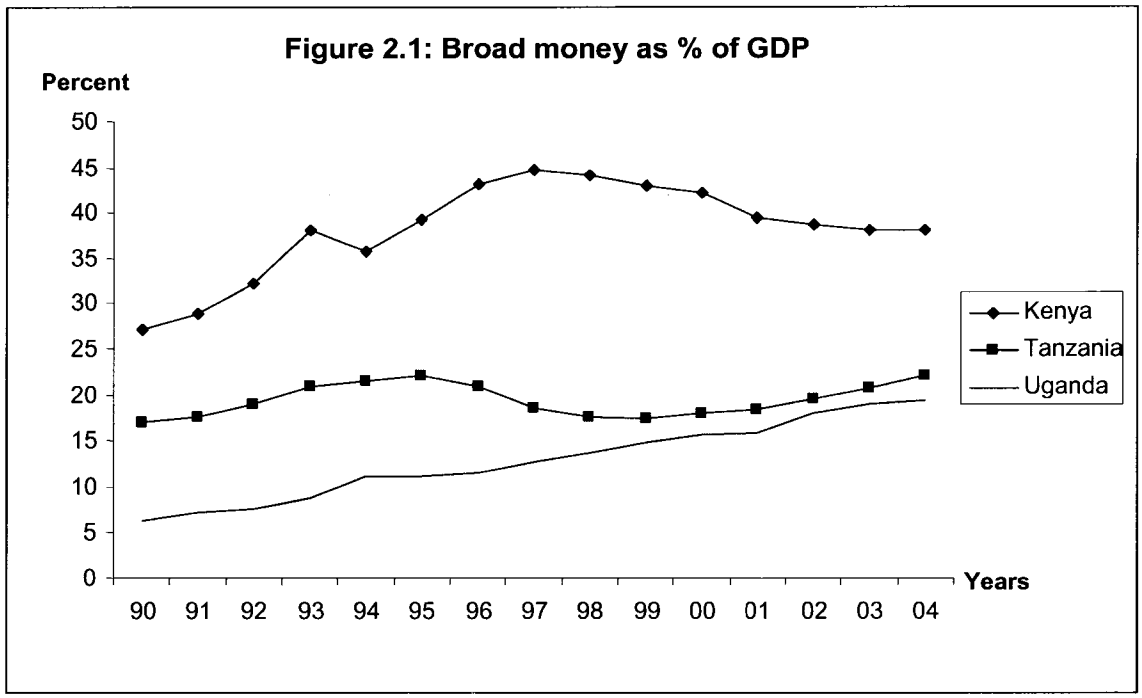


Figure 2.2 shows the development in private sector credit relative to GDP. The trend in the ratio of private sector credit to GDP is almost similar to that of broad money to GDP. Although Kenya has the highest ratio, the private sector credit as a percentage of GDP has bee declining in recent years, while that of Uganda (which has the lowest ratio) has been constantly rising. In Tanzania, the initial impact of financial sector reforms led to a sharp decline in the credit to private sector as a percentage of GDP, reaching approximately 3.1 in 1996 which is well below that of Uganda in the same year. However, since 1997 the private sector credit has grown very fast, stand at about 9.2 of GDP in 2004 compared to 6.8 for Uganda in the same year.

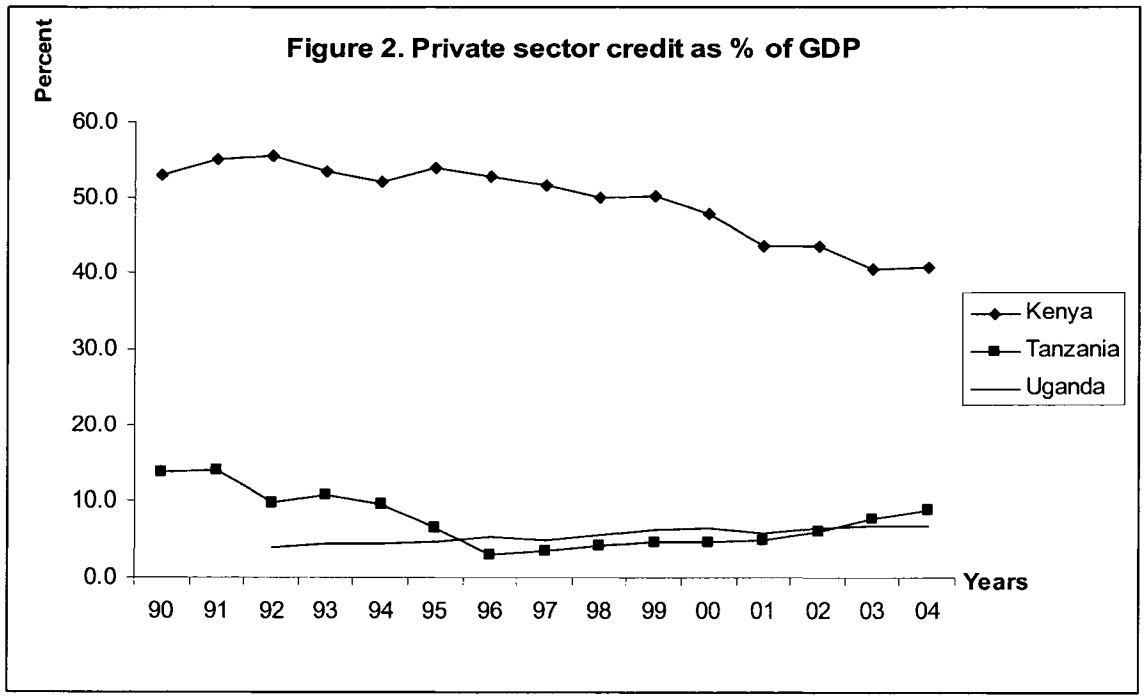


Figure 2.3 gives a comparative picture of magnitudes of interest rate spreads in the East African region for the period 1994 to 2004. Interest rate spread is defined as the difference between average interest rate earned on interest earning assets (loans) and average interest rate paid on deposits. Generally the three countries have been experiencing relatively large spreads when compared to the ones prevailing in developed countries, which are in the proximity of 4 percent (Table 2.3). As shown in Table 2.3, the presence of high interest rate spreads in developing countries (especially those in sub-Saharan Africa) is not unusual. The main reason behind high interest rate spreads in these countries may be attributed to the presence of high intermediation costs, reflecting the weaknesses and inadequacies of their financial sectors. However, owing to the ongoing financial sector reforms, which are aimed at enhancing competition, the interest rate spreads, in the East African region have shown a declining trend over time. For

example, in Tanzania, the spread declined from 18.2 percent in 1995 to about 9.7 percent in 2004, representing a decrease by 46.7 percent. As figure 2.3 shows, Uganda has generally experienced a relatively lower interest rate spread in the past decade, compared to the other two countries in the region. For Uganda, The average interest rate spread in the past ten years stood at about 11.6 percent while that of Tanzania and Kenya was about 15.0 and 13.2 percent respectively during the same period. Also Table 2.3 shows that the Ugandan average interest rate spread during the period under review, is one percentage point lower than the average of sub-Saharan African countries. Generally, the prevalence of relatively high interest spreads in the region goes a long way towards explaining the relatively low level of private sector credit as evidenced in figure 2.2 above.

Figure 3. Interest rate spreads, 1994-2004

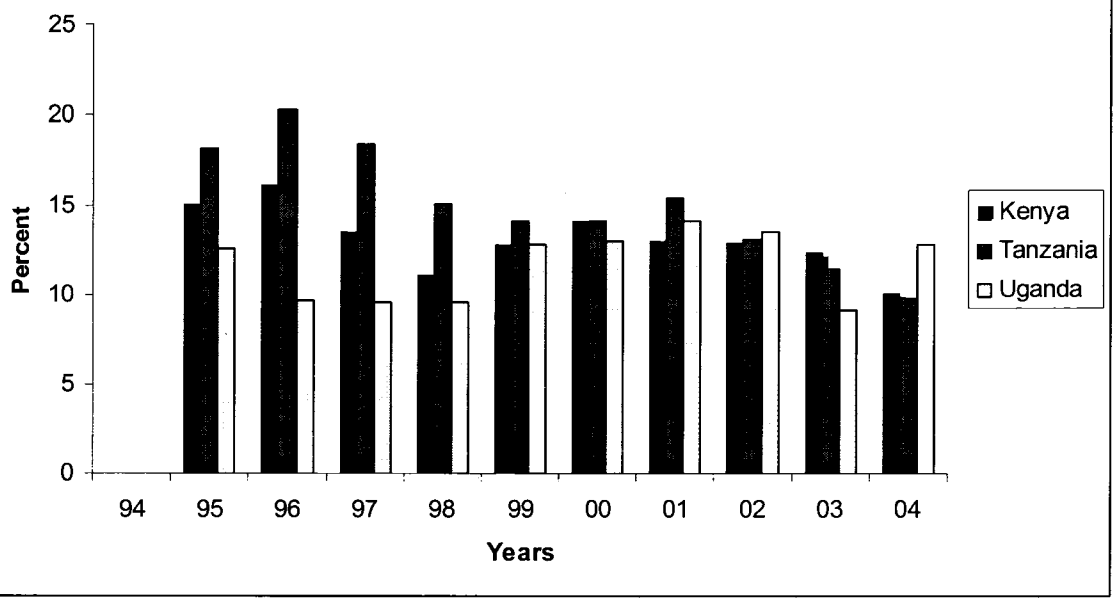


Table 2.3: Cross-country comparison of the interest rate spread, 1995-2004

Year	Kenya	Tanzania	Uganda	Sub-Saharan Africa	OECD
1995	15.2	18.2	12.6	10.5	4.3
1996	16.2	20.4	9.7	13.0	3.8
1997	13.5	18.4	9.5	12.6	3.8
1998	11.1	15.1	9.5	13.1	3.8
1999	12.8	14.1	12.8	12.8	3.6
2000	14.2	14.2	13.1	13.1	4.0
2001	13.0	15.5	14.2	13.7	4.0
2002	13.0	13.1	13.5	13.0	3.6
2003	12.4	11.4	9.1	12.4	3.6
2004	10.1	9.7	12.9	12.5	2.8
Mean	13.2	15.0	11.7	12.7	3.7

Source: World Bank's World Development Indicators Database

2.4 Concluding Remarks

The preceding discussion reveals that in recent years much progress has been made in the financial sectors of the three East African countries. The financial sector reforms have been wide-ranging and the sequencing of the reforms has been broadly appropriate, which helped avoid financial instability and disruptions. In all three countries financial sector reforms have established market-based systems of bank intermediation and government financing. The reforms have also allowed a conduct of monetary policy through indirect instruments, and contributed to the establishment and development of stock markets.

While the reforms have had some positive impacts in all the three countries, Uganda seems to have performed relatively better during the study period. For example, Uganda has maintained a positive growth in the ratio of broad money to GDP throughout the period while that of Tanzania and Kenya have undergone considerable fluctuations. A

similar trend was also observed in the ratio of private sector credit to GDP. Furthermore, Uganda has experienced a relatively lower interest rate spread (indicating higher intermediation efficiency) as compared to the other two countries. However, in order to be able to make an in-depth comparative analysis of the financial sectors in the region, it is necessary to establish levels of bank efficiency across the region. This will also make it possible to analyze the relationship between qualitative aspects of financial sectors and economic growth, including the channels of transmission.

CHAPTER THREE

Literature Review

3.1 Introduction

This chapter reviews the literature relevant to this study. Specifically it deals with the survey of some theoretical as well as empirical literature on the financial sector development and economic growth. The chapter also presents the major gaps in the existing studies that are addressed to by this study.

3.2 Theoretical Review

3.2.1 The concept of Efficiency[8]

The performance of firms, such as banks, is often described in terms of the firm's efficiency. The measured efficiency of a production unit is commonly interpreted as the difference between its observed input and output levels and the corresponding optimal values. An output-oriented measure of efficiency compares observed output with the maximum output possible for given input levels. Alternatively, an input-oriented efficiency measure compares the observed level of inputs with the minimum input that could produce the observed level of output. These are measures of technical efficiency and, as such, ignore the behavioural goals of the firm.

Measures of allocative efficiency compare the observed mix of inputs or outputs with the optimal mix that would minimize cost, maximize profit or obtain any other behavioural goal. Allocative efficiency can be combined with technical efficiency to measure overall

[8] The discussion here follows that of Kumbhakar and Lovell (2000), Berger and Humphrey (1991) and Coelli T. (1998)

efficiency. In addition, measures of technical efficiency can be used to construct measures of scale efficiency, which involve a comparison of observed and optimal scale, or size, of the firm. One can also measure scope efficiency, which involves a comparison of the cost of producing the observed mix of outputs in a single firm with the costs that would prevail if each output was produced in a separate firm. Each of the above mentioned concepts are discussed in detail below.

3.2.2 Scale Efficiency

Scale efficiency refers to the relationship between the per-unit average production cost and production volume of a firm. For example, a firm that increases its production of outputs can see its unit cost of production decline, because the cost of some elements of inputs is fixed, such as administrative and overhead expenses. This is called economies of scale. However, diseconomies of scale are also possible if the average production cost starts to rise with outputs beyond a certain volume of production. Diseconomies of scale may arise because it may be more costly to manage a very large firm, or because the management of a very large firm becomes entrenched and therefore concerned more about maximizing their own welfare than that of shareholders. If the average cost curve is U-shaped due to economies of scale at a low output level and diseconomies of scale at a high output level, it implies that there is an optimal scale of production at which the per-unit average production cost is minimized. If a firm operates outside of the optimal scale, then it is said to be experiencing scale inefficiency.

3.2.3 Technical Efficiency

The concept of technical efficiency relates to the question of whether or not a firm uses the best available technology in its production process. It refers to the physical relationship between outputs and inputs used in the production process. Kumbhakar and Lovell (2000) define technical efficiency as the ability of a firm to minimize input use in the production of a given output vector or the ability to obtain maximum output from a given input vector. Hence technical inefficiency refers to the inability of a firm to use a set of inputs to generate the highest attainable output from those inputs. In other words, a technically inefficient firm could produce the same output with less of at least one input, or could use the same inputs to produce more of at least one output. The aim of measuring firm level efficiency is to estimate the frontier that envelops all the input/output data with those observations lying in the frontier being described as technically efficient while the observations lying above/below the frontier are considered to be technically inefficient.

From the above definition, one may note that the basis for technical efficiency is production theory. For example, consider a producer employing a number of inputs $\mathbf{X} = (x_1, \text{------}x_n)$ purchased at a given input prices $\mathbf{W} = (w_1,\text{------}w_n)>0$ to produce a single output q, which is sold at a fixed price $p>0$. This producer would transform inputs in to outputs efficiently along a production function $f(\mathbf{x})$, a function that shows the maximum attainable output from the inputs used in production. Thus the function f(x) is the production frontier as it characterizes an output maximizing behaviour of an efficient producer. If a firm produces its output with a production plan (q_o,x_o), such a plan would

be termed technically efficient if $q_o = f(x_o)$ and technically inefficient if $q_o < f(x_o)$. Thus, given the maximum feasible output $f(x_o)$, technical efficiency (TE) would be measured theoretically as $TE = q_o/f(x)$, which defines technical efficiency as the ratio of observed output to maximum feasible output. q_o achieves its maximum feasible value of $f(x_o)$ if and only if TE = 1. Otherwise TE < 1 provides a measure of a shortfall of observed output from maximum feasible output. Note that Technical efficiency can not exceed one.

The concept of technical efficiency is important to firms because their profits depend highly upon their value of technical efficiency. For example, two firms that have identical technologies and inputs but different levels of technical efficiency, will have different levels of output. This will create higher revenue for one firm although both have the same costs obviously generating a larger profit for the more efficient firm.

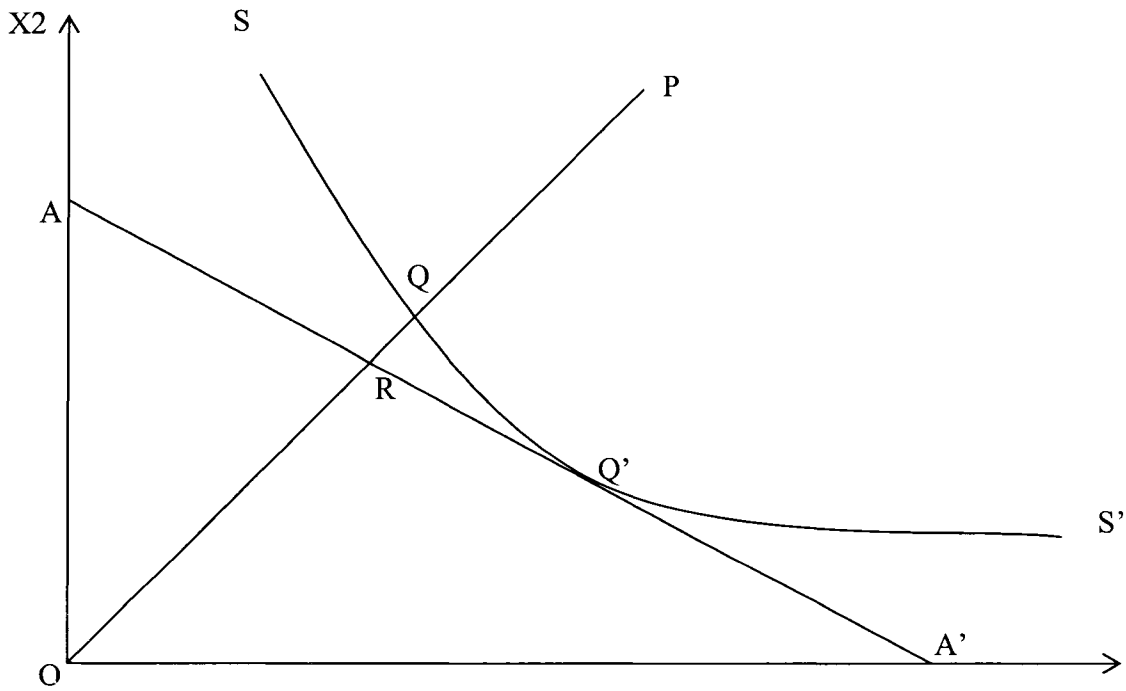
3.2.4 Economic Efficiency

Economic efficiency is defined as the ratio of the minimum costs that could have been expended to produce a given output bundle to the actual cost expended. Economic efficiency is a broader concept than technical efficiency as it includes both technical and allocative efficiency. Allocative efficiency reflects the ability of a firm to use inputs in optimal proportions, given their respective prices. Therefore economic efficiency reflects the optimal inputs chosen based on both production technology and input prices. For example, consider two firms of varying degrees of technological and allocative efficiency, but facing identical prices. The firm with higher profits within a certain

range of prices is considered the relatively more efficient one. But this does not necessarily imply that the higher profit firm is both technically and allocatevely efficient. It is quite conceivable that one might be allocatively more efficient but technically more inefficient than the other and vice versa. But the extent of superiority in any one of the efficiencies over the other firm would outweigh the extent of its inefficiency in the other component in comparison to the other firm. Conceptually these two components can be illustrated by the diagram below which is adopted from Kumbhakar and Lovell (2000)[9].

[9] The diagram was originally developed by Farrell (1957)

Figure 2.1: Technical and allocative efficiency



Source: Kumbhakar and Lovell (2000)

Figure 2.1 illustrates a case in which a firm is assumed to be producing a single output y using two inputs (x1 and x2) under the assumption of constant returns to scale[10]. The curve SS' is an isoquant representing technically efficient combinations of input X1 and X2 used in producing output y. AA' is an isocost line which shows all combinations of inputs X1 and X2 such that input costs sum to the same total cost of production. Since the efficient isoquant represents the production frontier, all points in SS' are technically efficient. If a given firm uses quantities of inputs defined by point P to produce a unit of output, the technical inefficiency of that firm could be represented by the distance QP,

[10] For an extension that accommodates more than two inputs, multiple outputs and non constant returns to scale, an interested reader may refer to Farrell (1957).

which is the amount by which all inputs could proportionally be reduced without a reduction in output. Therefore the efficiency of a firm can be measured by the ratio OQ/OP, which is equal to one minus QP/OP. It takes a value between zero and one and hence provides an indicator of degree of the technical inefficiency of the firm. The value of one would indicate that the firm is fully technically efficient. For example, point Q is technically efficient because it lies in the efficient isoquant. The distance OR relative to OQ measures the fraction of costs for which the output could be produced if the relative uses of inputs were altered. Therefore the ratio OR/OQ represents allocative efficiency. Pont Q' is technically efficient as well as allocatively efficient as it represents the least feasible coast combination of X1 and X2 in the production of y. Hence at point Q' the producer is economically efficient. In practice, researchers have found that banks suffer more from technical inefficiency than from scale or scope inefficiency (Berger and Humphrey, 1991).

3.3 Economic Growth

3.3.1 Theories of Economic Growth[11]

Probably the oldest formal model of economic growth known is that of Harrod-Domar model. Harrod [1939] and Domar [1946] attempted to analyse the relation between investment, employment and growth to show that economic growth is directly related to the savings rate and indirectly to the capital-output ratio. The Harrod-Domar model has three basic assumptions, namely: (1) the Leontieff aggregate production function, (2) no

[11] The discussion here follows that of Romer, David (2001), and Branson, W. H (1989)

technological progress and (3) a constant savings rate. To understand their analysis, consider the following simplified framework that incorporates the three basic assumptions:

Let Y be gross domestic product (GDP) and S be savings. The level of savings is a function of the level of GDP, say $S = sY$. The level of capital K needed to produce an output Y is given by the equation $K = \sigma Y$ where σ is called the capital-output ratio. Investment (I) is the change in capital stock. Thus $\Delta K = \sigma \Delta Y$. In a closed economy, planned savings is equal to planned investment ($I = S$).

Therefore,

$I=\Delta K=\sigma\Delta Y$
and $I=S$
so
$\sigma\Delta Y = sY.$

Therefore the equilibrium rate of growth g is given by
$g = \Delta Y/Y = s/\sigma$

It follows from above analysis that growth is directly related to the savings rate, and indirectly to the capital output ratio. If the capital output ratio is constant, then the growth rate is determined by the savings rate.

3.3.2 Solow Growth Model[12]

The Solow model is a modification of the Harrod-Domar model. The key modification is that the Solow model allows for the substitution between factors of production, i.e. labor and capital. Capital-output and capital-labor ratios are not fixed. The model also assumes that there are diminishing returns for the use of these inputs. The model provides the basic framework for the study of convergences across countries.

The model starts with the labor augmenting (or Harrod neutral) production function of the form

$$Y = F(K, AL) \tag{1}$$

where Y is output, K is capital and A is the effectiveness of labor, so that AL is a unit of effective labor. We can divide equation (1) by effective labor, AL, to obtain

$$Y/AL = F(K/AL) \tag{2}$$

We let $Y/AL = y$ (output per effective unit of labor) and $K/AL = k$ (capital per effective unit of labor); so that the intensive production function is given by

$$y = f(k) \tag{3}$$

Recall that

$$k = K/AL \tag{4}$$

Taking natural logarithms on both sides, we get,

$$\text{Ln } k = \text{Ln}K - \text{Ln } A - \text{Ln } L \tag{5}$$

[12] The discussion here follows that of Romer D, 2006.

We differentiate both sides with respect to time in order to obtain growth rates;

$$dLnk/dt = dLnK/dt - dLnA/dt - dLnL/dt \quad (6)$$

Solow assumes that the growth rate of the effectiveness of labor (A) is exogenously given by g, while that of labor is given by n. It is further assumed that the growth rate of capital is given by marginal propensity to save, *sf(k)* minus the depreciation rate (δ). So equation (6) can be rewritten as

$$\dot{k} = sf(k) - (n+g+\delta)k \quad (7)$$

where k is the actual amount of gross investments per effective labor unit, *sf(k)* is the rate of capital deepening, and $(n+g+\delta)k$ is the amount of required investments per labor unit in order to keep k fixed. Thus change in capital per worker is determined by three things: it is positively related to savings (investments) per worker, and negatively related to the population growth and depreciation rate.

The key prediction of the Solow growth model is that, over time the economy converges to a steady state that is independent of the initial conditions. That is, if all parameters (saving rate, population growth rate, and technology) are identical among countries, then all will converge to the same steady state. This prediction is very crucial in the debate over convergence or catching up. According to the model, poor countries with lower capital-labor ratio would experience higher rates of growth than rich countries, leading to the same steady-state. This prediction is referred to as *absolute convergence.* Assuming heterogeneous economies with distinct steady-states, each country would converge to its own steady-state, growing at a rate that depends on its deviation from the steady-state. This is called *conditional convergence.*

Each country will converge to its steady-state at a speed that is independent of the saving rate and the technology level. The predicted speed of convergence implies that a country is able to move half the way to its steady-state in about 13 years. However, this convergence speed seems to be inconsistent with the empirical evidence[13].

3.3.3 Endogenous Growth Theory

In the Solow model output is produced by capital and labor. Economic growth is compatible with labor-augmenting technical progress, which acts as if it were increasing the available amount of labor. In the long-term, output per capital and labor productivity grow at an exogenously given rate of technical progress. Technical progress is entirely exogenous to this model so that in reality economic growth is left unexplained.

Even though the Solow model is a useful framework, new theories have emerged in response to some of the unrealistic assumptions of the model. The Solow model shows that technological improvement is the only source of continual growth. Therefore, in order to understanding economic growth dynamics it is important to recognise the factors that drive technological progress. This is the starting point of the endogenous growth theories. Endogenous growth theories focus on two growth mechanisms: capital investment and research and Development (R&D) on the one hand, or accumulation of physical and human capital on the other. The endogenous growth theory emerged in the 1980s, and Romer (1986) and Lucas (1988) were important contributors. This theory

[13] See Barro and Sala-i-Martin (1995)

distinguishes itself from the neoclassical theory by emphasizing that technological progress is an endogenous outcome of an economic system, not the result of forces that impinge from outside.

In a pioneering paper, Romer (1986) postulates that technological change is the major determinant of economic growth. Technological changes are defined as improvement in the way inputs are combined to produce final products. The endogenous growth theories do not emphasise the concept of convergence and are based on either constant or increasing returns to scale in capital. They do not rely on an unexplained source of technical change as the engine of growth; instead they focus on the existence of a variety of endogenous variables that spur economic growth. Since technology or knowledge improvements can work as a source of continual growth, the new growth theory includes knowledge and technology as independent factors in their models.

Most of the endogenous growth models share the same common theme of overcoming the limitation of diminishing returns to capital by introducing human capital, innovations, externalities and government. The deviation from the neoclassical assumptions results in sustained growth and in a great potential for government policies to influence long-run growth. Alternative market settings, typically imperfect competition, have been adopted and incorporated into the new models to reflect the inadequacy of perfect competition as the main stream market framework. The models vary in their settings, from the two conventional aggregate inputs (physical capital and labor) to multiple inputs and from a single aggregate consumption good to a variety of consumer goods. Different approaches have been

endeavored to attain sustained growth that does not rely on exogenous forces but rather on forces from within the system. Ideas and product innovations, human capital, externalities, and government policies stand as the principal pillars in the construction of new growth theories.

The interesting feature of the economic growth models surveyed in this section is the absence of any recognition accorded to the financial sector. The Harrod-Domar model employs the savings rate but makes no reference to institutions and markets that intermediate between savers and investors. There need to be mechanisms by which the resources of savers are channelled to users who promise best returns. This is the role played by the financial institutions.

3.3.4 Financial Sector Efficiency and Economic Growth

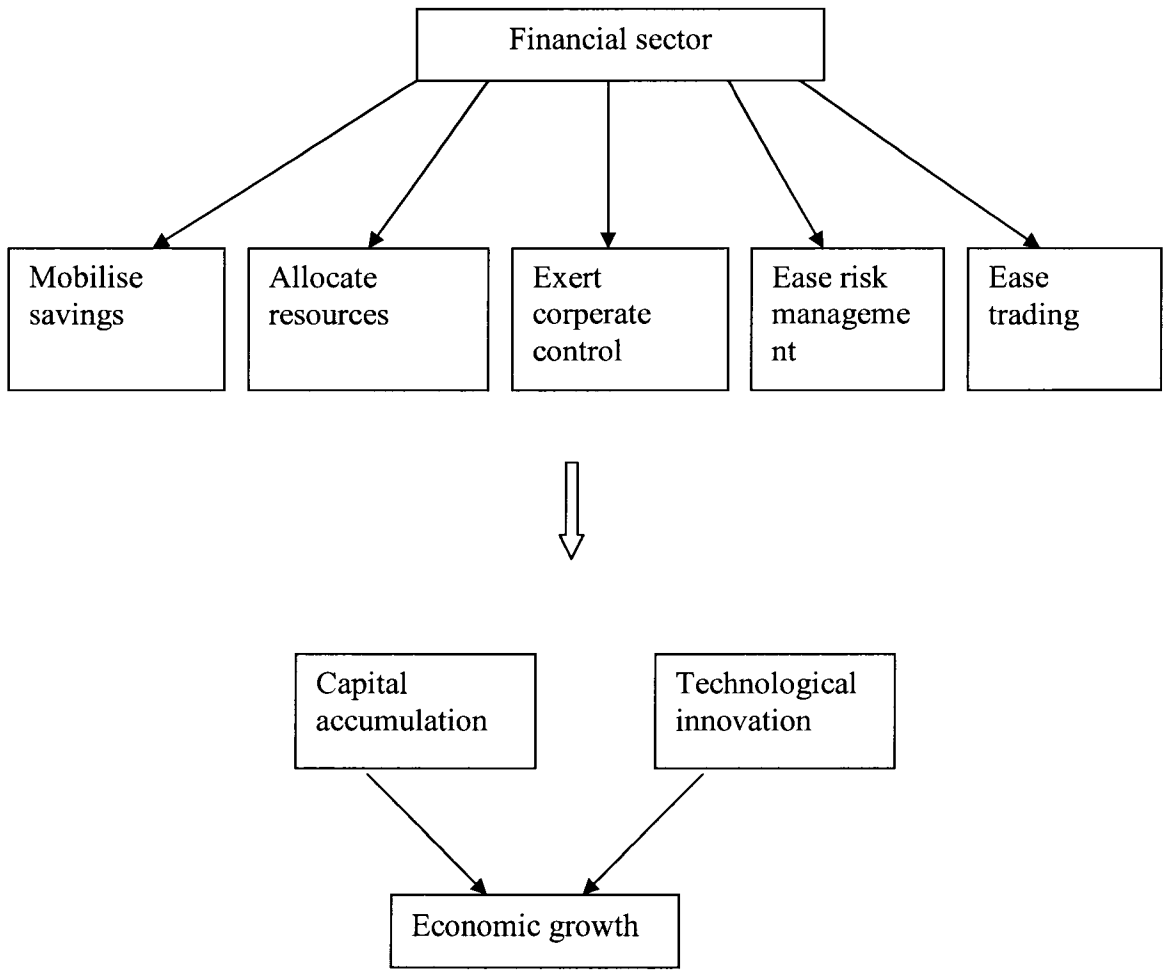
There is a large body of theoretical and empirical literature on the role of financial sector development in economic growth[14]. The recognition that an efficient financial sector has a significant and positive impact on economic growth was first made by Schumpeter (1912), who states that financial markets play an important part in the growth of the real economy. He specifically stresses the role of an efficient banking sector as an accelerator of economic growth due to its role as a financier of productive investments. This is what Patrick (1966) refers to as the "supply leading" role of the financial sector according to which, the widespread expansion of financial institutions leads to economic growth. However, it was not until the late sixties and early seventies that economists like Goldsmith (1969) and McKinnon (1973) again turned their attention to the influence of

[14] For a comprehensive survey of theoretical literature on finance-growth link, see Gertler (1988) and Thakor (1996). Also see Levine (1997) for a comprehensive overview of theoretical and empirical studies.

the financial sector and documented a relationship between financial development and economic growth.

Levine (1997) identifies five basic channels through which an efficient financial sector influences economic growth. These channels may be represented by figure 3.1 below, which illustrates how financial arrangements provide five functions that affect savings and allocation decisions, and how these functions then influence economic growth through two channels, namely capital accumulation and technological innovation. Levine argues that market frictions like information and transaction costs motivate the emergence of a well-developed financial sector.

Fig 3.1: The channels through which the financial sector influences economic growth



Source: Levine (1997) with some modifications

Following Levine (1997), the meaning of the functions in figure 3.1 can be elaborated as follows: First of all, the mobilization of savings is perhaps the most obvious and important function of the financial sector. The provision of savings facilities enables

households to store their money in a secure place, and allows this money to be utilized productively by lending it to individuals or enterprises to finance investments, thus encouraging capital accumulation and promoting private sector development. Without the pooling of individual savings through financial intermediaries, the scale of investment projects is more likely to be constrained below what might be efficient. Investments and thus capital accumulation and technological innovations depend on mobilised savings, which increase with a more developed financial sector. Thus, an efficient financial sector will relax credit constraints in an economy, which may improve the investment rate and accelerate economic growth.

As noted by Andersen (2003), the basis for accelerating economic growth is the allocation of resources to new and higher return projects. Individual savers are unlikely to have the time or capacity to collect, process and compare information on many different enterprises, managers and market conditions before choosing where to invest. In addition, they will be less keen to invest in activities about which they have little information. Thus high information costs may prevent capital from flowing to its highest value use. Financial intermediaries that specialise in acquiring and evaluating information on potential investment projects enable small investors, for a minimal fee, to locate higher return investments. The improved allocation of savings among investment projects should enhance growth prospects. Efficient financial institutions may also increase the rate of technological progress by identifying and thus allocating capital towards those innovations with the best chances of succeeding (King & Levine, 1993).

The financial sector exerts corporate control and serves in the monitoring of investments to reduce the risk of resource mismanagement. The ability of banks to monitor the performance of enterprises on behalf of many investors, who would not otherwise have the resources to do so individually, and to exercise corporate control (e.g. lenders holding meetings with borrowers to discuss business strategy) helps to ensure that investors receive returns that properly reflect enterprise performance (i.e. ensures enterprises are not being defrauded by the managers of firms as a result of their lack of information), and creates the right incentives for the managers of the borrowing enterprises to perform well. Thus financial arrangements that improve corporate control tend to promote faster capital accumulation and growth by improving the allocation of capital (Bencivenga and B. Smith 1991).

Regarding risk management, banks are uniquely positioned to intermediate across maturities. Many projects or enterprises require a medium to long-term commitment of capital, whereas most savers prefer to have the option to draw on their savings, or move them into another investment opportunity should the need arise, i.e. they like their savings to be 'liquid'. Banks accept funds from investors who desire to lend for short term and in turn lend to borrowers who desire long term maturities. Thus borrowers and lenders with different preferred maturities are not compelled to agree on a common maturity. This is possible because banks combine many household savings and, usually, all servers are not expected to withdraw their money at the same time. Also banks bear the risk of borrowing at volatile, short-term interest rates and lending at stable long-term interest rates. By doing so, they help to ensure that capital is allocated to the best

projects, even if they require a long-term financial commitment (e.g. Bencivenga & Smith 1991). They can also affect the rate of technological change if long-term commitments of resources to research and development promote technological innovation.

The theories mentioned above cover the main views in the theoretical finance-growth debate by suggesting links by which financial sector development can affect economic growth. However, Gregorio and Guidotti (1995) consolidate the framework presented in figure 3.1 in to two main channels by which efficient financial sector can promote economic growth. They argue that financial sector development has a dual effect on economic growth. An efficient financial sector can contribute to economic growth by enhancing the efficiency (productivity) of capital or by increasing the supply (volume) of credit in the economy, which, in turn, stimulate investment and growth. They proposed a production function in which output is assumed to depend only on capital stock:

$$y_t = f(k_t), \qquad (8)$$

where y_t and k_t, denote output and the stock of capital at time t, respectively. By totally differentiating the above equation and denoting the rate of growth of output by $\hat{y}$, the savings rate (dk/y) by s, and the marginal productivity of capital by ϕ_t, we have:

$$\hat{y} = dk_t/yt\ f'(k_t) = s_t\phi_t \qquad (9)$$

Equation (9) above suggests that the rate of output growth is the product of the savings rate and the marginal productivity of capital. On the one hand, the development of the

domestic financial sector may enhance the efficiency of capital stock or investment (hence increasing ϕ_t). On the other hand, an efficient financial sector can contribute to raising the volume of savings and, thus, investments (hence, increasing s_t). The former effect was first emphasized by Goldsmith (1969), who also found some positive correlation between financial development and the level of real per capital GNP. He attributes this correlation to the positive effect that financial development has in encouraging the more efficient use of capital stock. The latter effect is particularly attributed to the works of McKinnon (1973) and Shaw (1973), who emphasise the role played by financial sector liberalization in increasing the volume of savings and, hence, of investments. They argue that repressive financial policies through measures such as interest rate ceilings, directed credit, high reserve requirements and restrictions of entry into the banking industry, reduce the rate of economic growth by retarding financial development. The foundation of their analyses is that interest rates have a positive relationship with economic growth and that low interest rates would therefore impede growth. In this view then, when interest rates are kept artificially low, there will be low incentives for saving hence little funds to lend, limiting investment and therefore the growth of the economy. In this case, intermediation is repressed.

The removal of controls in a financially repressed economy therefore implies that the interest rates will increase resulting in higher savings. These higher savings means the availability of more investment capital and hence an increase in output. In this study we test, among other things, whether financial sector development affects growth by

increasing the volume of investments (savings), its efficiency (capital productivity) or both.

3.4 Empirical Review

3.4.1 Introduction

This section reviews literature in the areas of bank efficiency and finance-growth relations. The purpose of this review is not to be exhaustive, but rather to present the main developments in the fields as well as to identify the remaining gaps in the literature and highlight the contribution made by this study. In the bank efficiency section of the review, studies on bank efficiency in single countries are presented first, followed by studies of bank efficiency across countries. Studies relating financial sector to economic growth follow next and the section concludes with remaining gaps in the literature.

3.4.2 Literature on Bank Efficiency Studies

Much research effort has been expended on identifying and analysing the efficiency of financial institutions in varying forms over the last few decades (see Berger and Humphrey (1997) for a comprehensive survey). The main areas of research have been scale efficiency, scope efficiency as well as the X-efficiency, which attempts to capture the efficiency of a bank (given its inputs, outputs and prices) relative to other banks. X-efficiency studies of the banking sector typically find that there are large cost inefficiencies. A common finding is that, on average, there are cost inefficiencies in the order of 20 percent. That is, on average, banks are only 80 percent as cost efficient as the "best practice bank" (Berger and Humphrey (1997).

In recent years, some efforts have also been directed towards studying the effects on bank efficiency of bank activities such as mergers and acquisitions, liberalization of the financial sector, and market characteristics such as concentration. The vast majority of bank efficiency studies have used costs rather than revenues and profits functions and have, usually, specified a translog functional form, which impose a U-shape on the multi-product average cost curve. In this section we will review studies that have been done on both a single country and those that compare efficiency among countries.

3.4.3 Studies of Bank Efficiency on a Single Country

Much of the research to date using different frontier methods as applicable to the banking sector has been done using the cost function, where cost efficiency gives a measure of how close a bank's costs are to what a best-practice bank's costs would be for producing the same output bundle under the same conditions. It is derived from a cost function in which variable costs depend on the prices of variable inputs, the quantities of variable outputs and any fixed inputs or outputs and random errors.

Berger and Humphrey (1992) used a thick frontier approach, which is a modified version of the stochastic econometric method, to compare bank cost efficiency and to study the shifts in the best-practice costs between 1980 - 1984 on the one hand and 1988 on the other using data for virtually all USA banks. Their finding is that the thick frontier approach gives slightly higher estimates of inefficiencies, i.e. Banks are less efficient than the stochastic frontier approach suggests. This is especially true when they allow inefficiencies to vary over time. The authors note that the bank itself may still be fully

efficient relative to a conventional bank frontier that allows banks to be measured as efficient even if they have branches that are inefficient.

In their study of efficiency of bank branches, Berger, Leunsner and Mingo (1994) estimated the cost frontier for over 760 branches of large US commercial banks during 1989 – 1991. They specified and compared both the intermediation and the production approaches and find that most branches are smaller than in the efficient scale. The branch level X-efficiencies dominate the scale efficiency, similar to the findings in bank level research.

Resti (1997) investigated the efficiency of Italian banks over the period between 1988 and 1992. To estimate the efficiency of the Italian banking industry, Resti (1997) applied the Battese and Coelli (1988) version of the stochastic frontier approach and data envelopment analysis and compared the results. Resti found a very high rank-order correlation between DEA and SFA of 0.73 to 0.89, which he interpreted as showing that the cost efficiency results from both methods do not differ dramatically.

Bauer et al. (1998) compared four major methods of estimating bank efficiency, i.e. the stochastic frontier approach, distribution free approach, thick frontier approach and data envelopment analysis to estimate the efficiency of the US banking industry over the period between 1977 and 1988. The authors proposed a set of consistency conditions that frontier efficiency measures should meet to be most useful for regulatory analysis or other purposes. The main purpose of the paper was to compare the efficiency of US bank

efficiency using variants of all four of the major approaches. Their finding suggests that the parametric methods were generally consistent with one another. However, the finding also suggests that the parametric and non-parametric methods were generally not mutually consistent; the rank-order correlation between the two approaches was very low.

Kwan and Eisenbeis (1996) used a stochastic econometric cost frontier approach to study bank efficiency for a sample of 254 bank holding companies from 1986 to 1991. They employed three inputs (i.e. labor, funds and capital) and five outputs (i.e. investment securities, real estate loans, commercial and industrial loans, consumer loans and off-balance sheet commitments and contingencies). Their finding suggests that substantial inefficiencies exist in banking, averaging between 10 to 20 percent. They also found that, after controlling for scale differences, the average small banking firms are relatively less efficient than the average large firms and that smaller firms exhibit higher variations in inefficiencies than their larger counterpart.

Berg et al (1993) studied bank efficiency in Norway, Sweden and Finland using data envelopment analysis, by employing both separate frontier for each county and then with common frontier. Their data set consisted of 503 Finland banks, 150 Norwegian banks and 126 Swedish banks. They employed three outputs (i.e. total loans, total deposits and number of branches) and two inputs (i.e. labor measured in man-hours per year, and capital measured in book values of machinery and equipment). The authors found that the Swedish banks were 52-63 percent more efficient than the Finish and 40-60 percent more efficient than the Norwegian. They also found that the largest Swedish banks were

among the most efficient units in the pooled sample, hence concluding that they are in the best position to expand in a future common Nordic banking market.

Feacher and Pestieu (1993) apply the stochastic production frontier approach to evaluate technical efficiency for eleven financial service sectors in OECD countries. Employing aggregate value added net of indirect taxes as a measure of each country's financial service sector output, and employment in the financial service sector and capital as inputs, they found that Japan has the most efficient financial services, while Denmark is the least efficient. They also observed a trend toward converging changes in multifactor productivity, coinciding with that of the development of the European Community.

Rim (1996) applied a stochastic cost frontier to estimate bank efficiency in the U.S.A. and Japan. He used two outputs (i.e. deposits and loans) and three inputs (i.e. the price of labor, the price of capital and the price of funds). The findings from the study suggested that the U.S.A. multinational banks and small and medium Japanese banks were operating at cost-efficient output levels. The author also found that U.S.A. domestic banks were enjoying increasing returns to scale, implying that the average size of domestic U.S.A. banks was not optimal. The results also showed that the large banks in Japan had the largest measure of input X-inefficiency amounting to 38.5 percent of total costs as well as significant levels of economies of scale.

Carbo and Williams (2002) used the Fourier flexible functional form and the stochastic cost frontier approach to evaluate scale and X-inefficiencies across European savings

banks between 1989 and 1996. The authors found that scale economies are widespread across different countries and that they increase with bank size. They also show that scale economies range between 7 and 10 percent, while X-inefficiency measures were around 22 percent.

Their finding also showed that, overall, large savings banks have scale economy advantages over their smaller counterparts. However, size did not appear to confer advantages in terms of X-efficiency. Given these results, Carbo and Williams concluded that European savings banks could obtain cost reductions through reducing managerial and other inefficiencies and also by increasing their scales of production.

3.4.4 Empirical Literature on Financial Sector Development and Economic Growth

The available empirical studies have attempted to investigate the different aspects of the relationship between financial sector development and economic growth by exploring the existence of this relationship, the direction of causality between the two variables and the channels of transmission between them. Regarding the existence of the relationship between financial sector and economic growth, most studies have confirmed a positive association between the two variables. Also some studies lend support to the supply leading hypothesis, which means financial sector influence economic growth, while some found that causality can run one way or the other depending on a particular country.

Gregorio and Guidotti (1995) examined the relationship between financial development and long-run growth by using the ratio of bank credit to the private sector to GDP as the indicator of financial development and two different data sets. First, the authors extended Barro's (1991) cross country growth regressions for a sample of 18 countries during 1960 – 1985 by including a proxy for financial development as an additional explanatory variable. Second, using Gregorio's (1992) panel data set for 12 Latin American countries during 1950 – 1985, they explored the relationship between financial intermediation and growth in Latin America.

The findings from Barro's (1991) data set indicate a positive effect of financial development on long-run economic growth. However, the positive effects were particularly strong in middle and low income countries but weak in high income countries. The author argued that the weak relationship observed in high-income countries is due to the fact that financial development occurs to a large extent outside the banking system, while the proxy used for financial development focused on banking sector development.

Also the findings suggested that the relationship between financial development and economic growth in Latin America was negative. The authors interpreted this effect in the light of the extreme experiments of financial liberalization that were witnessed by Latin America during the 1970's and 1980's and which subsequently collapsed.

King and Levine (1993) studied whether higher levels of financial development are associated with faster current and future rates of economic development using data on

over 80 countries from 1960 through 1989. The authors constructed four indicators of financial development designed to measure the services provided by financial intermediaries: financial depth, which is the ratio of liquid liabilities of the financial system to GDP; the ratio of deposit money bank domestic assets to deposit money bank domestic assets plus central bank domestic assets, the ratio of claims on the non-financial private sector to total domestic credit and the ratio of claims on the non financial private sector to GDP.

The authors conducted both a purely cross–country analysis using data averaged over the 1960 – 1989 period and a pooled cross-country time–series analysis using data averaged over the 1960's, 1970's and 1980's. After controlling for other factors associated with economic growth, the results of their study show that there is a strong positive relationship between each of the four financial indicators and long-run real per capita GDP growth rates. The findings suggested that indicators of the level of financial development are strongly correlated with economic growth, the rate of physical capital accumulation and improvements in the efficiency of capital allocation. The findings also suggest that the predetermined components of the financial development indictors, significantly predict subsequent values of the growth indictors. The authors therefore conclude that their findings are consistent with the view that financial services stimulate economic growth by increasing the rate of capital accumulated and by improving the efficiency with which economies use that capital.

Ahmed and Ansari (1998) studied the relationship between financial sector development and economic growth for three major South-Asian countries, namely, India, Pakistan and Sri Lanka for the period 1973 - 1991. They employed three different measures of financial sector development namely, the ratio of M2 to nominal GDP, quasi-money as a percentage of nominal GDP and the ratio of domestic credit to nominal GDP.

Results of the correlation analysis indicated a high degree of association between financial sector development and economic growth. Also the results of Granger causality tests provided strong support for the supply-leading hypothesis, i.e. financial development causes economic growth. Finally, the regression results, using pooled data based on time–series and cross–sectional observations reinforced the findings of the causality analysis.

Choe and Moosa (1999) conducted a study to examine the relationship between economic growth and the financial system as a whole using Korea as a case study. Their emphasis was on the relative importance of capital markets and financial intermediaries in economic growth. They designed several financial indicators that can reflect the relative importance of capital markets and financial intermediaries. The first indicator is the growth rate of the households sector's holdings of securities and equities in its financial assets, which is a measure of the household sector's access to capital markets. The second indicator is the growth rate of the household sector's holdings of various deposits in its financial assets, which is a measure of the household sector's access to financial intermediaries. The authors defined similar indicators for the business sector and then

investigate the relationship between these indicators and two indicators of economic growth, namely real GDP growth and the growth rate of gross fixed capital formation.

The results of causality tests show that financial development in general leads to economic growth. Their findings also suggest that, despite the measures of capital market liberalization, financial intermediaries are still more important than the capital markets in this cause and effect relationship.

Odedokum (1996) proposed a framework for conducting empirical tests of the effect of financial development on economic growth and applied it to the study of the impact of financial development on economic growth for 71 least developed countries (LDCs) over varying periods that generally span the 1960s and 1980s. He also employed a modified form of the existing framework to the same data and compared the results. He further enquired whether or not the effects of financial development on economic growth vary across different regional groups of countries as well as across countries at different levels of economic development.

He used financial depth (proxied by the ratio of the average nominal value of the stock of liquid liabilities to the nominal annual GDP) as a measure of financial development. After controlling for other factors affecting growth (labor force growth, investment-GDP ratio, and real export growth), the results suggested the following.

First, the findings suggested that financial development promotes economic growth in about 85 percent of the 71 countries in the study. Second, financial intermediation is practically at par with the export expansion and capital formation ratio, and superior to labor force growth as partners in promoting economic growth. Third, the growth promoting effects of financial intermediation are more predominant in low-income than in high-income LDCs. Lastly, the findings indicated that the growth promoting effects of financial intermediation are practically invariant across the various regions of the globe.

Al-Mashat (2002), conducted a study to examine how improvements in financial intermediation stimulated non-governmental savings and hence economic growth in Egypt for the period 1960 –1999. He constructed three measures of financial development namely, the cost of capital approximated by the real interest rate, the volume of intermediation measured by the ratio of M2 to GDP and the effectiveness of financial intermediation proxied by the ratio of reserve money to total deposits.

The regression results revealed a positive relationship between growth and financial sector reforms. However, their results may not be an inclusive representative since the analysis is based on only one country.

Bolbol et al (2005) examined the effects of bank-based and market-based financial developments on the efficiency of total factor productivity for the period covering 1974 – 2002. The authors measured financial development by aggregate variables that reflect

bank and market-based indicators. For the bank-based indicators, they used the ratio of domestic credit to the private sector to GDP and the ratio of commercial bank assets to the sum of commercial banks and central bank assets. Regarding the market–based indicators, they used the ratio of market capitalization to GDP and turn over ratio. After controlling for population growth and investments, the findings suggest that bank-related financial development indicators had a negative impact on total factor productivity growth. However, when these indicators were interacted with per capital income of above USD 1265, they produced a positive impact.

The authors argued that, higher per capital income is usually associated with a better investment culture and greater efficiency in financial intermediation. On the other hand, the market-based financial development indicator had a positive effect on total factor productivity growth, especially when associated with private resource flows. Based on the above results, the authors conclude that widening financial development to include the stock market has paid off for Egypt, and that this process could contribute more to total factor productivity growth if more privatization is undertaken.

Andersen (2003) investigates the influence and effects of financial development on economic growth using cross section data for 60 countries for the period from 1965 to 1999. The author developed three measures of financial sector development namely, liquid liabilities designed to measure the size of the financial sector, credit to the private sector, which serves as an indictor of functioning of the financial sector; and the volume

of credit provided by banks to capture financial sector development. Annual average growth in GDP per capital was used as a measure of economic growth.

The author used the OLS method to perform regression analysis, which also involved a number of control variables. The empirical findings suggested strong and significant relationship between financial development and economic growth. The direction of causality was also established showing financial sector influence on subsequent GDP per capital growth. The findings also showed a strong influence of financial sector development on long-term economic growth than on simultaneous growth. The author concludes that a more developed financial sector will improve economic growth and that facilitating extension and making arrangements for the financial sector to develop, especially by relaxing credit constraints, will exert a large impact on economic development.

Berger et all (2004) investigates the effects of the efficiency of community banks on economic growth using data from 1993 to 2000 in 49 nations. They also investigate potential transmission mechanisms through which the efficiency of community banks affects economic growth. The author hypothesised two potential modes of transmission. One transmission mechanism is through improved financing opportunities for small and medium enterprises (SMEs) and the second is through greater overall flows of bank credit. The variables used to measure the relative health of community banks are the total market shares of community banks (defined in various ways) and their weighted-average

efficiency ranks estimated using cost and profit functions for the banks in each nation in each year.

The findings generated from the reduced-form regressions suggest that both market shares and the weighted–average efficiency ranks of community banks have positive and statistically significant coefficients in GDP growth. The estimated coefficients of increasing the market shares and efficiency ranks of these banks were also economically significant. Regarding the transmission mechanism, the empirical findings provide only mixed support for the two hypothesised transmission mechanisms from the relative health of community banks to economic growth. The finding suggested that the relative health of small banks was positively associated with both the SME employment share and the overall bank lending to GDP ratio in both developed and developing countries. Moreover, these intermediate variables were found to be positively related to GDP growth. However, the findings did not show any substantial diminishing of the measured effects of the relative health of the small banks on GDP growth when the intermediate variables were included in the GDP growth regressions for developed and developing countries.

Andrus Oks (2001) examined the relationships between the efficiency of the financial intermediaries and economic growth among Central and Eastern European countries (CEEC) for the period 1992 – 1999. The author suggested four different financial indicators to proxy financial sector efficiency: ratio of bank credit to the private sector to GDP, ratio of claims on the private sector to domestic credit, ratio of domestic credit

issued by deposit banks to domestic credit issued by deposit banks and the central bank, and the wedge between the interest rate of the loans and the deposits. The industrial production index was used to proxy for GDP (a measure of economic development). Empirical analysis was done by using a method developed from a framework of King and Levine (1993), which concentrates on pulled regressions and involves granger causality. The findings of the study suggest that depending on the time period and sub-sample, the correlation of financial development with economic growth can be negative or positive, and the causality (in the Granger sense) can run one way or the other, depending on the particular country.

Koivu (2002) empirically examined whether relatively large and more efficient banking sectors accelerate economic growth in 25 transition countries using panel data for the period 1993 – 2000. He emphasises both the importance of qualitative and quantitative aspects of the banking sector. The author measured qualitative development in the banking sector with the margin between lending and deposit rates (which is a measure of efficiency of the banking sector), while quantitative development was measured by the amount of bank credit allocated to the private sector as a share of GDP. Economic development was measured in terms of annual real GDP growth.

The empirical findings from the study support the view that the presence of an efficient banking sector accelerates economic growth in the transition economies, as the interest rate margin was found to be positively and significantly associated with economic growth. The findings also suggest that the amount of bank credit allocated to the private

sector, apparently does not speed up economic growth in transition countries and causality seems to run mostly from economic growth to credit growth. The author argues that the main reasons behind this result could be the numerous banking crises the transition countries have experienced and the soft budget constraints that are still prevalent in many transition countries. Apparently, when the business environment is not ready for growth in the amount of finance, the growth in the latter may be unsustainable and may do nothing to accelerate economic growth. In the worst case, such growth in the amount of available finance may precipitate a financial crisis and harm economic development.

3.4.5 Concluding Remarks

From the above literature review, several observations can be made. First the volume of African studies has not matched that of the rest of the world, especially the U.S.A and Europe. Despite the objective of financial sector reforms to improve competition and efficiency of the financial systems on the continent, only a handful of studies have investigated bank efficiency characteristics on the continent. To our knowledge, no study has attempted to undertake a comparison of bank efficiencies among African countries. In addition, although most empirical studies on the relationship between financial development and economic growth suggest a positive first order relationship, evidence in Africa is still limited. No study, to our knowledge, has investigated the effects of financial sector development on economic growth in the East African region. Since the role of the financial sector in economic growth has not been investigated sufficiently in Africa, this study could make a significant contribution in this respect.

Second, from the finance-growth literature, we note that some studies have attempted to establish whether financial deepening leads to improved growth performance, while others have dealt with the strength and direction of this relationship. Some studies have also focused on identifying the channels of transmission from financial intermediation to economic growth. However, as Berger et al (2004) have noted, researchers have not come to consensus regarding exactly which dimension of the financial system matters most – the size of the financial system or its efficiency. While the majority of the studies point to the strong link between financial sector development and economic growth, it remains unclear whether the financial system improves economic growth primarily through higher levels of investment or primarily through improving the quality of investment. So far, the variables used by most of the studies emphasise the role played by the size of the financial system in promoting economic growth. The issue relating to how efficient the bank is in channelling the deposit to loans, thus its ability to provide quality investments has been ignored in linking financial intermediation to economic growth.[15] This study intends to contribute to the finance-growth literature by focusing on the ignored dimension – the efficiency of the financial system.

As mentioned earlier, the use of bank efficiency helps to avoid the problem of causality between finance and growth since financial sector efficiency measures the ability of the

[15] As Appendix 1 shows, with the exemption of Berger et al (2004) study, all the others have focused on the share or quantity effects of financial sectors without considering their efficiency or quality.

sector to use inputs correctly – a measure which is certainly less dependent on economic growth than the size of the financial system[16].

Lastly, the above finance-growth literature points to the fact that some studies only employ the financial development variable as the determinant of economic growth in the regression equation that is empirically estimated. Odedokum (1996) argues that, by neglecting other growth determining variables - like the share of investment in the GDP and labor force growth, their estimated results of the impact of the financial development variable could hardly be free of the bias caused by the omitted variables and hence little reliance could be placed on their findings. To avoid this problem, this study used a number of control variables that have been established from other studies to have an impact on economic growth.

[16] The causality between the size of the financial sector and economic growth may run both ways. High initial levels of financial development can cause higher growth or higher growth may induce the need for a bigger financial sector.

CHAPTER FOUR

Methodology

4.1 Introduction

This chapter provides a discussion of methodology which is used to (1) estimate bank efficiency, (2) analyze the relationship between bank efficiency and economic growth and (3) examine the channels of transmission from financial sector to economic growth. The chapter also discusses the estimation techniques, data requirements and sources.

4.2 Measures of Efficiency

Producer performance depends on the state of technology and the degree of efficiency. The state of technology is represented by a frontier relation between inputs and outputs and inefficiency reflects waste and misallocation relative to this frontier. There are two main approaches to estimating production frontiers and measuring efficiency scores. One is based on a parametric specification of an econometric model that allows for stochastic disturbances (*stochastic frontier approach*) and the other uses a non-parametric mathematical programming technique to envelop a data set (*data envelopment analysis)*

4.2.1 Stochastic Frontier Analysis (SFA)

The frontier methodology has been widely recognized as Farrell's original work published in a seminal paper in 1957. One of the fundamental assumptions underlying parametric frontier econometric models is that there is a parametric function linking output and input variables. In other words, a specific functional form is considered in the parametric frontier, while the non-parametric frontier (such as DEA) does not use a

functional form. Parametric models can be classified into the deterministic and the stochastic frontiers. The deterministic frontier makes no allowance for random shocks. It therefore, attributes all variations in output not associated with variation in inputs to technical inefficiency. Following Kumbhakar and Lovell (2000), the deterministic production frontier model can be written as follows:

$$y_i = f(x_i;\beta).TE_i \qquad (10)$$

where y_i is the scalar output of producer i, $i = 1, \ldots\ldots, I$, x_i is a vector of N inputs used to produce yi, $f(x_i;\beta)$ is the production frontier, and β is a vector of technology parameters to be estimated. Then technical efficiency TE is given by

$$TE = \frac{y_i}{f(x_i;\beta)}, \qquad (11)$$

which defines technical efficiency as the ratio of observed output to maximum feasible output. Consequently, in equation (11), the entire shortfall of observed output is attributed to technical inefficiency. Such a specification ignores the fact that output can be affected by random shocks that are not under the control of a producer (Kumbhakar and Lovell, 2000).

To overcome the problems associated with deterministic frontier models which do not allow for the existence of random shocks, Aigner, Lovell, and Schmidt (1977) and Meeusen and Van Broeck (1977) simultaneously introduced stochastic frontier models. These models not only allow for technical inefficiency but also acknowledge the fact that random shocks outside the control of the producers can affect output. The great virtue of

stochastic production frontier models is that the variations on output due to random shocks, such as the weather and just plain luck, can be separated from that of variations in technical and allocative efficiencies.

The essential idea behind the stochastic models is that the error term is composed of two parts. The first part is the random term, which accounts for the measurement error and other random factors, such as the effect of the weather, strikes, luck, etc., on the value of output. The second component is a one-sided error term which captures the effects of inefficiency relative to the stochastic frontier. The stochastic frontier model is often referred to as the "composed error" model because of the two components to the error term. The stochastic frontier model can be expressed as in equation (12), which is similar to equation (10) except for its statistical noise component.

$$y_i = f(x_i;\beta).\exp\{v_i\}.TE\,, \tag{12}$$

Where, $[\,f(x_i;\beta).\exp\{v_i\}\,]$ is the stochastic production frontier. The term $f(x_i;\beta)$ is a deterministic part common to all producers; $\exp\{v_i\}$ is a producer specific part, which captures the effects of random shocks on each producer. If the production frontier is specified as being stochastic as in equation (12), then technical efficiency can be measured as

$$TE = \frac{y_i}{f(x_i;\beta).\exp\{v_i\}} \tag{13}$$

which defines technical efficiency as the ratio of observed output to maximum feasible output in an environment characterised by $\exp\{v_i\}$.

An appropriate formulation of a stochastic frontier model in terms of a general production function for the i^{th} production unit is

$$y_i = f(x_i, \beta) + v_i - u_i = f(x_i, \beta) + \varepsilon_i \qquad (14)$$

where v_i is the two-sided noise component and u_i is the non negative technological inefficiency component of the error term. The Maximum Likelihood method is normally used to estimate the values of both β and u_i.

4.2.2 Data Envelopment Analysis (DEA)

The data envelopment analysis is a non-parametric technique used to analyse production, cost, revenue and profit data of a number of entities called Decision Making Units (DMUs). It involves linear programming methods to construct a non-parametric frontier over the data. In other words, instead of using traditional regression analysis to find an average relationship, a piecewise linear surface is produced that yields a convex production possibilities set. The technique identifies the set of best practice observations for which no other firm can produce as much or more of every output given the inputs. Efficiency measures are then calculated relative to this surface. The DEA assumes that there are no random fluctuations so that all deviations from the estimated frontier represent inefficiency.

There are two most frequently used versions of DEA model: the CCR-model (so named after Charnes, Cooper, Rhodes, 1978) and the BCC-model (named after Banker, Charnes and Cooper, 1984). The main difference between these two models is the treatment of returns to scale: while the latter allows for variable returns to scale, the former assumes that each DMU operates with constant returns to scale.

4.2.3 CCR-model

Charnes, Cooper and Rhodes introduced a measure of efficiency for each DMU that is obtained as a maximum of a ratio of weighted outputs to weighted inputs. The weights for the ratio are determined by the restriction that the similar ratios for every DMU have to be less than or equal to unity. The efficiency measure is then a function of the weights of the input-output combination. Formally, the efficiency measure for DMU_0 can be calculated by solving the following mathematical programming problem:

$$\text{Maximize } h_0(u,v) = \frac{\sum_{r=1}^{s} u_r y_{r0}}{\sum_{i=1}^{m} v_i x_{i0}} \tag{15}$$

Subject to

$$\frac{\sum_{r=1}^{s} u_r y_{rj}}{\sum_{i=1}^{m} v_i x_{ij}} \leq 1, j = 1,2.....n \tag{16}$$

$$u_r \geq 0, r = 1,2,.....,s \tag{17}$$

$$v_i \geq 0, i = 1,2,.....,m \tag{18}$$

where x_{ij} = the observed amount of input of the i_{th} type of the j_{th} DMU ($x_{ij} > 0$, i=1,2,...,m, j=1,2,...,n) and y_{rj}= the observed amount of output of the r_{th} type for the j_{th} DMU ($y_{rj} > 0$, r = 1,2,...,s, j = 1,2,...,n).

The variables u_r and v_i are the weights to be determined by the above programming problem.

For the above linear programming problem, the dual can be written as follows:

$$\underset{\lambda}{Min}\, z_0 = \Theta_0 \tag{19}$$

Subject to

$$\sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{r0}, r = 1,2,...,s \tag{20}$$

$$\Theta_0 x_{i0} - \sum_{j=1}^{n} \lambda_j x_{ij} \geq 0, i = 1,2,....,m \tag{21}$$

$$\lambda_j \geq 0, j = 1,2,....n \tag{22}$$

Both above linear problems yield the optimal solution Θ*, which is the efficiency score (so-called technical efficiency or CCR-efficiency) for the particular DMU_0. The value of Θ is always less than or equal to unity and DMUs for which Θ* < 1 are

relatively inefficient and those for which $\Theta^* = 1$ are relatively efficient, having their input-output combination points on the frontier.

4.2.4 BCC-model

The DEA model that exhibits variable returns to scale is called the BCC-model, and was developed by Banker, Charnes and Cooper (1984). The input-oriented BCC-model for the DMU_0 can be written formally as:

$$\underset{\lambda}{Min}\, z_0 = \Theta_0 \tag{23}$$

Subject to

$$\sum_{j=1}^{n} \lambda_j y_{rj} \geq y_{r0}, r = 1,2,...,s \tag{24}$$

$$\Theta_0 x_{i0} - \sum_{j-1}^{n} \lambda_j x_{ij} \geq 0, i = 1,2,....,m \tag{25}$$

$$\sum_{j=1}^{n} \lambda j = 1 \tag{26}$$

$$\lambda_j \geq 0, j = 1,2,....n \tag{27}$$

The efficiency scores obtained from the above model are purely technical efficiency. This is so because the model allows variable returns to scale and therefore the scale part of the efficiency is eliminated. Under constant returns to scale (CRS), we assume that outputs change in direct proportion to the change in inputs regardless of the size of the DMU. When we have a group composed of DMUs with large scale of operations, CRS may be inappropriate. Variable returns to scale (VRS) assumes that changing inputs do not result in to proportional change in outputs. That is, as a DMU become larger, its average cost would either fall or rise. This may be a better reflection of the actual observations found in the real world.

4.2.5 Stochastic Frontier versus Data Envelopment Analysis

In this study, the DEA model is used to estimate bank efficiency under both cases of constant and variable returns to scale in order to facilitate the decomposition of the efficiency scores into scale and technical efficiencies. We choose to adopt DEA model instead of parametric approaches such as stochastic frontier approach (SFA), due to lack of high quality and reliable data for our sample. Note that while the parametric approaches require more information for estimating production or cost frontier, the DEA approach attempts to reduce the information required to estimate the frontier. For example, it uses only the data on inputs and outputs and does not take direct account of input prices. Furthermore, the DEA approach requires no assumptions about the functional form of the frontier and the one sided error structure. Parametric approaches, on the other hand distinguish between random errors and inefficiency, but do so along the lines of somewhat arbitrary assumptions about their respective distributions, and, in

addition, impose a particular functional form, which, if miss-specified, risks overstating inefficiency (Hauner and Peiris, 2005). Finally, by its nature, SFA requires a large sample size while DEA can work equally well with a small sample size. Resti (1997) shows that the cost efficiency results from both DEA and stochastic frontier analysis methods do not differ significantly. In practice, bank efficiency studies have used nonparametric and parametric methods similarly frequently (Berger and Humphrey, 1997).

4.2.6 Definition of Bank Output and Inputs

Measuring bank efficiency requires the identification of inputs and output of the banking sector. However, despite the increasing interest in studying the banking industry, there is no agreement among the researchers on what constitutes bank inputs and outputs. Attempts to define these concepts were made earlier by Sealy and Lindley (1977), Colwell and Davis (1992) and later by Berger and Humphrey (1997). There are two main approaches to the definition of the inputs and outputs of the banking sector, which reflect different perspectives of the banking activity: the production and intermediation approaches.

The production approach emphasises operational activity and thus banks are primarily viewed as providers of services to customers. The input set of this approach includes only the physical variables (e.g. labor, materials, space or information system) or their associated costs, since only physical inputs are needed to perform transactions, process financial documents or provide advice to customers. Interest expenses are excluded

from this approach on the grounds that only the operational process is of interest. The output of this approach represents the services provided to customers and is best measured by the number and type of transactions dealt with, documents processed or specialized services provided over a given time period. When detailed transaction flow data is not available, data on the stock of deposit and loan accounts are often used instead as a proxy for the level of services provided.

Under the intermediation approach, financial institutions are viewed as primarily intermediating funds between savers and investors. Banks produce intermediation services through the collection of deposits and other liabilities and their application in interest-earning assets, such as loans, securities and other investments. This approach includes both operating and interest expenses as inputs, whereas loans and other major assets of financial institutions count as outputs. However, there is a longstanding controversy whether deposits should count as inputs or outputs. Different trends in the debate on the identification of banking output led to the establishment of the asset, user cost and value-added approaches, which can be seen as variants of the intermediation approach. All these approaches are focused on the intermediation activity of banks[17].

For this study, the intermediation approach[18] is employed for two reasons. First, we are concerned with how efficient the banks are, in channelling funds from depositors to lenders. Second, the absence of data on the number of deposit and loan accounts makes it

[17] For a detailed description of these approaches, see Berger and Humphrey (1997).

[18] This approach is due to C. W. Sealey and T. Lindley (1977)

impossible to apply the production approach in our study. Accordingly, the outputs (y_i) and inputs (x_i) can be specified as follows: y_1= total loans extended, y_2= Debt securities, x_1 = fixed capital and equipments, x_2 = Labor (wages and salaries), x3 = total deposits received plus borrowing.

The DEA model can either be output oriented or input oriented. This option refers to the choice of objective function to be optimized in the linear program behind DEA. The output oriented approach is defined as maximizing the level of outputs given inputs. This approach is particularly appropriate when the management is interested in raising efficiency without necessarily reducing resources usage. On the other hand input oriented approach is concerned with maintaining at least the same level of outputs while minimizing inputs usage. For this study, we adopt output oriented DEA since in practice, banks have more controls on their outputs (for example loans and securities) than their inputs (for example deposits). The basic DEA model specification used in the analysis is as follows:

$$Maximize \quad \Theta = \frac{U_1 LOANS_i + U_2 SECURITIES_i}{V_1 CAPITAL_i + V_2 LABOR_i + V_3 DEPOSITS_i} \tag{28}$$

Subject to

$$\text{DMU}_1 \quad \frac{U_1 LOANS_1 + U_2 SECURITIES_1}{V_1 CAPITAL_1 + V_2 LABOR_1 + V_3 DEPOSITS_1} \leq 1$$

$$\text{DMU}_2 \quad \frac{U_1 LOANS_2 + U_2 SECURITIES_2}{V_1 CAPITAL_2 + V_2 LABOR_2 + V_3 DEPOSITS_2} \leq 1$$

$$\text{DMU}_N \quad \frac{U_1 LOANS_N + U_2 SECURITIES_N}{V_1 CAPITAL_N + V_2 LABOR_N + V_3 DEPOSITS_N} \leq 1$$

Where:

LOANS is the total loans extended, SECURITIES is Debt securities, CAPITAL is the fixed capital and equipments, LABOR is the labor usage proxed by employee compensation and DEPOSITS is the total deposits received plus borrowing. U_i is the weight attached to the i^{th} output, V_i is the weight attached to the i^{th} input and N is the number of DMUs.

The objective function is to maximize the efficiency scores Θ for the best practice decision making unit (DMU_i), subject to the constraint that when the same set of *u* and *v* weights (coefficients) is applied to all other DMUs being compared, no DMU will be more than 100 percent efficient.

The model was estimated by DEAP[19] computer program using annual data for all commercial banks operating in each country in each year for the period 1994 to 2005[20]. The short period of time is basically due to lack of reliable data on commercial banks prior to this period. As mentioned earlier, most of the financial sector reforms in the East African region started in the first half of 1990s, and as such there is no reliable and accurate data on commercial banks before the reforms.

4.3 Modelling Bank Efficiency and Economic Growth

The empirical analysis of the effects of the banking system efficiency on the region's economic growth is based on an equation relating the GDP growth to bank inefficiency scores as one of the independent variables among others used to control for other factors affecting growth. Specifically, we adopt a framework based on the conventional neo-classical one sector production function in which financial development constitutes an input, as proposed by Odedokun (1994):

$$Y_t = f(L_t, K_t, F_t, Z_t) \qquad (29)$$

where:

Y = Aggregate output or real GDP

L = Labor force

K = Capital stock

[19] The DEAP software can be downloaded from the internet at www.uq.edu.au/economics/cepa/deap.htm. I thank Prof. Tim Coelli at the University of New England Australia for providing the DEAP software for free.

[20] It is important to note that over the review period, there was an entry of new banks in to the financial systems while some banks exit the market. But this is not expected to affect our results, since our objective is to obtain the average efficiency scores in each year for each country.

F = Measure of level of financial development

Z = Vector of other factors that can be regarded as inputs in the aggregate production process.

We assume a production function of Cobb-Douglas type:

$$Y_t = e^h K_t^{\alpha} L_t^{\beta} F_t^{\theta} Z_t^{\delta} . \tag{30}$$

Taking a natural log of both sides, we get

$$LnY_t = h + \alpha LnK_t + \beta LnL_t + \theta LnF_t + \delta \ln Z_t \tag{31}$$

As far as the role of financial sector development in economic growth is concerned, the main variable that is widely used as indicator of financial development is the volume of credit allocated by banking system in the economy. We argue that a volume of credit may have little contribution towards economic growth if such credit is not efficiently allocated. One way through which banking system can contribute to economic growth is its ability to allocate financial capital to those projects where the marginal product of capital is highest. Thus, the capital that is channeled to its best possible use results in a higher capital productivity thereby promoting growth. This key function of the banking system can best be captured by the efficiency of the banking system.

Therefore, following Lucchetti et al (2001), the variable F_t in equation (31) can be thought of as a composite of both qualitative and quantitative aspects of the banking sector. The quantitative aspect would be captured by the volume of credit funneled to the

economy by the banking sector, while the qualitative aspect would be captured by a measure of banking sector efficiency. Accordingly, variable F_t can be replaced by a new measure of development of banking system which takes explicit account of the banking system inefficiency as follows:

$$F = \frac{C}{(1+i)^{\lambda}} \tag{32}$$

where C is the amount of credit allocated by the banking system in the economy, i is the measure of bank's inefficiency and λ is the weight of such inefficiency in the allocative process. For simplicity, we drop time subscript. From equation (32);

$$\theta LnF = \theta Ln\left[\frac{C}{(1+i)^{\lambda}}\right] \quad = \theta LnC - \psi Ln(1+i) \tag{33}$$

where $\psi = \theta\lambda$

Substituting (33) in to (31) we get,

$$LnY = h + \alpha LnK + \beta LnL + \theta LnC - \psi Ln(1+i) + \delta LnZ \tag{34}$$

For simplicity we use lower case letters to denote logarithms of the variables so that equation (34) becomes:

$$y = h + \alpha k + \beta l + \theta c - \psi \ln(1 + i) + \delta z \quad (35)$$

Equation 35 reveals two possible ways through which financial development can affect growth: it can rise c which is the volume of credit extended by banking system, or it may reduce i which is the banking sector inefficiency. If financial sector development affect growth of output by increasing the volume of credit in the economy, then θ will be statistically different from zero. On the other hand if the impact is through the efficient allocation of financial resources then ψ will be statistically different from zero. If both the volume of credit and the efficiency allocation of such credit play autonomous and significant role in promoting economic growth, then both θ and ψ will be statistically different from zero. After adding the error term (u_t), which is expected to satisfy the usual assumptions, equation (35) can be written as:

$$y = h + \alpha k + \beta l + \theta c - \psi \ln(1 + i) + \delta z + u \quad (36)$$

Variable Z is intended to capture additional control variables that influence the growth rate of GDP. Inclusion of these variables will help to eliminate the bias caused by omitted variables. Furthermore, by including control variables, we can assess the strength of an independent link between bank efficiency and growth. Since growth theories are not explicit enough about what independent variables belong to the true regression, our selection of these additional control variables is based on the results of the Savvides (1995) study on the determinants of economic growth in Africa. Following this study, the author suggests three variables that are significant determinants of growth in Africa. These variables are: Inflation rate (INF), international trade (TRADE) and Government expenditure (EXP). Therefore the estimated model over all time periods (T) and cross section units (N) can be given as:

$$y_{it} = h + \alpha k_{it} + \beta l_{it} + \theta CREDIT_{it} + \psi EFFIN_{it} + \xi(EFFIN_{it} * CREDIT_{it}) + \gamma INF_{it} + \delta TRADE_{it} + \Omega EXP_{it} + u \quad (37)$$

For i = 1.....N, and t = 1 ....T.

4.3.1 Definition of Variables and Model Specification

Table 4.1 below, gives a summary of description of the terms in equation (37) above.

Table 4.1: Variable description

Variable	Variable name	Variable description
h	Constant term	Expected to capture productivity effects of Hicks-neutral technological progress
EFFIN	Bank efficiency	Average bank efficiency scores
CREDIT	Credit to Private sector	Claims on the private sector by deposit money banks as % of GDP
*EFFIN*CREDIT*	Interaction term	Simple multiplication of the bank efficiency scores and credit to private sector
l	Labor force growth	Annual growth rate of population size
k	Growth rate of capital	Growth rate of the ratio of investment to GDP
INF	Inflation	Annual percentage change of CPI
TRADE	International trade	Ratio of the sum of imports and exports to GDP
EXP	Government expenditure	The ratio of government final consumption to GDP

The annual growth rate of population size is used as a proxy for the labor force growth, while the growth rate of capital is proxied by the growth rate of the ratio of investment to GDP. To capture the impact of qualitative aspect of financial sector in the economy, we use the average efficiency scores (*EFFIN*) obtained form the estimation of DEA model in equation 28. Note that the variable *EFFIN* enters equation (37) with a positive sign to indicate the use of efficiency scores as opposed to inefficiency scores (variable i) as in equation (36). *CREDIT* is the ratio of credit to the private sector to GDP and is expected

to capture the extent of intermediation[21]. The inclusion of this variable will serve several purposes. First, it will prevent the influence of bank efficiency from becoming indistinguishable from the effects of growth in the size of financial sector. Second, it will enable us to compare our results with previous results, since most studies have used this variable as a measure of financial sector development. We also include an interaction term (EFFIN *CREDIT), which is intended to measure the interaction between bank credit and efficiency scores, with the expectation of a positive interaction effect. That is, we expect the marginal benefit of an increase in the commercial bank credit to the private sector to be greater, the more efficient these banks are.

Equation 37 was estimated by EViews version 5 computer program using panel data for the three countries of Tanzania Kenya and Uganda covering the period 1994 to 2005 and results are presented in section 5.2. We also tried to replace the variable *EFFIN* by an alternative measure of bank efficiency (*MARGIN*) and compare the results. *MARGIN* is the spread between commercial bank lending and deposit rates. It is hypothesized that higher spread is associated with higher operating costs reflecting management's inability to combine inputs optimally. Therefore, higher spread can be used as an indicator of bank inefficiency. Koivu (2002) argues that, the interest margin is likely a good estimator for efficiency in the banking sector as it describes transaction costs within the sector. If the margin declines due to a decrease in transaction costs, the share of savings going to investments increases. As growth is positively linked to investment, a decrease in transaction costs should accelerate economic growth. The interest rate margin may

[21] This variable has been used in many studies to proxy financial sector development. See for example Levine, et al. (2000), Allen and Ndikumana (2000)

also reflect an improvement in the quality of borrowers in the economy. This variable has also been used by Riaz et.al (2003) to measure bank efficiency of Pakistan financial sector.

4.3.2 Testing the Channels of Transmission

To the extent that the relationship between bank efficiency and economic growth was established, we endeavour to analyze the channels through which the financial sectors contribute to economic growth. In section 1.7, two possible transmission mechanisms were hypothesized. One possible transmission mechanism is through improved *capital productivity* resulting from the ability of more efficient banks to channel available funds to the most productive users. A second mode of transmission is through *increased volume of capital* or savings and therefore increased investment and economic growth.

The two hypothesized channels of transmission were tested in two ways:

First, we included the two variables; capital productivity and volume of savings to the growth equation and test for positive effects of these variables on GDP growth to see if capital productivity and volume of savings directly influence economic growth. Secondly, we estimate two separate equations, one for capital productivity and another for savings function to ascertain whether variations in these variables can be explained by bank efficiency variable (EFFIN) among other variables that have been associated with savings rate and capital productivity in other studies. Following Deaton, A. (1989), the saving function of the following form was estimated:

$$SAVINGS_{it} = \beta_0 + \beta_1 INT_{it} + \beta_2 GPDI_{it} + \beta_3 INF_{it} + \beta_4 EFFIN_{it} + \varepsilon \quad (38)$$

where, SAVINGS is the private savings measured as the deposit money bank's time and saving deposits, INT denotes savings rate, and GPDI is the gross private disposable income measured as per capita GNP. INF is the rate of inflation and EFFIN is the bank efficiency variable, both as defined before. We hypothesize a positive relationship between SAVINGS and INT variable to indicate that higher rates of interest on time and saving deposits will induce higher saving rates. The variable GPDI is expected to bear a positive sign since increases on the levels of private disposable income, lead to higher propensities to save and therefore higher savings. The rate of inflation (INF) is expected to have a negative impact on private savings. This is because in the inflationary environment, economic agents are expected to increase their demand for money in order to maintain their standards of living, and therefore they save less of their income. Finally, as stated in section 1.7, a positive relationship is expected for the bank efficiency variable (EFFIN) indicating that more efficient financial sectors enhance private savings.

To test for the positive association between capital productivity and bank efficiency, we examined the following linear equation:

$$IOCR_{it} = \beta_0 + \beta_1 K_{it} + \beta_2 EFFIN_{it} + \beta_3 ERD_{it} + \beta_4 FDI_{it} + \alpha_{it} \quad (39)$$

Where, IOCR stands for incremental output capital ratio, which measures output per unit of capital employed, and is used to capture the average productivity of capital[22]. An

[22] See Odedakum (1996) for use of IOCR as performance variable in policy evaluation

increase in this ratio indicates a rising productivity as either less capital is used to produce same level of output or more output is produced using same amount of capital. K is the total stock of capital and is used to capture the influence of degree of returns to capital. A diminishing returns technology would suggest that the average productivity of capital is inversely related to the capital stock, whereas a constant returns technology would indicate no relationship between the two variables. EFFIN is bank efficiency variable as defined before. Bank efficiency is expected to exert a positive impact on capital productivity because of improved intermediation and the screening and monitoring functions performed by the efficient financial institutions. ERD is expenditure on Research & Development (R&D) which is included to capture technological innovation. This variable is expected to show a positive association with capital productivity to indicate that an increase in the use of modern technology resulting from R&D has a positive influence on the average productivity of capital. However, due to lack of data on this variable, high-technology export as percentage of GDP was used instead[23]. Finally, FDI is foreign direct investment as a percentage of GDP and is introduced in the model to determine the extent to which variation in average productivity of capital is due to the better quality of foreign entrepreneurs. We hypothesize a positive association between this variable and capital productivity.

4.3.2 Data Sources

Data used for estimating bank's efficiency scores consist of (81) commercial banks of which (44) operating in Kenya and (22) and (15) operating in Tanzania and Uganda

23 High-technology exports are products with high R&D intensity, such as in aerospace, computers, pharmaceuticals, scientific instruments, and electrical machinery

respectively[24]. The data were obtained form the central banks of the respective countries and were converted to USA dollars by using each country's official exchange rates[25]. Table 4.1 below presents the summary statistics of aggregate bank level data used in the estimation of the DEA model in equation 28. As the table shows, Kenyan banking system is by far the largest, with average total assets being about 3 times and 5 times that of Tanzania and Uganda respectively. This can be explained in the light of the higher industrialization of the Kenyan economy when compared to those of the other two countries. Also as mentioned earlier, the Kenyan banking sector has been opened to private and foreign banks since independence.

Table 4.1 also indicates that commercial banks in the three countries have strong preference for holding debt securities (liquid, low-risk assets) as compared to extending loans. This is however, more pronounced in Tanzania and Uganda. The average loan to total asset ratio of the banking system is about 51 percent in Kenya while that of Uganda and Tanzania is about 31 and 23 percent respectively. The average loan to deposit ratio is about 67 percent in Kenya and about 33 and 46 percent in Uganda and Tanzania.

[24] As mentioned earlier, the number of commercial banks in each country varied considerably over the review period. The figures provided here are those of 2005

[25]The official exchange rates for each country is shown in appendix 2

Table 4.1 Bank data descriptive statistics, 1994 - 2005 (Millions of US dollar)

	Loans	Debt securities	Fixed assets	Wages and salaries	Deposits	Total assets
Kenya (44)						
Mean	3087	190	260	190	4606	5987
SD	470	21	58	21	496	645
Median	2938	188	234	188	4538	5947
Maximum	4067	228	356	228	5623	6993
Minimum	2582	164	202	164	4043	5177
Tanzania(22)						
Mean	472	443	52	46	1421	2046
SD	230	116	23	28	463	521
Media	413	450	49	44	1338	2110
Maximum	1079	643	241	128	2478	3417
Minimum	68	99	19	6	236	355
Uganda (15)						
Mean	364	305	71	27	780	1151
SD	73	203	9	11	309	334
Media	352	276	71	25	760	1076
Maximum	539	588	90	47	1346	1831
Minimum	296	42	60	8	395	747

Sources: Central bank of Kenya, Bank of Uganda, Bank of Tanzania and own calculations

Table 4.2 below presents the summary statistics for the macroeconomic variables used to estimate the growth model. Government expenditure was calculated as the ratio of general government final consumption expenditure as percentage of GDP. Trade is defined as the sum of exports and imports of goods and services measured as a share of gross domestic product. For inflation, we used the annual percentage change of the consumer price index. The investment – GDP ratio was computed as gross nominal fixed capital formation plus the increase in nominal stocks, both divided by nominal GDP. Labor force growth was proxied by population growth, which in turn, was calculated as the annual growth rate of population. Credit to private sector is defined as the claims on

the private sector by deposit money banks divided by GDP. The data on GDP growth, population growth, and inflation were sourced from the Bank of Tanzania's *Economic and Operations Report* (various issues), Bank of Kenya's *Annual Report* (various issues), and Bank of Uganda's *Annual Report* (various issues). The data on private sector credit, investment, trade and the government expenditure are from the International Monetary Fund's *International Financial statistics (various issues),* and the World Bank's *World Development Indicators* database. To the extent that all variables used in the estimation of the growth model are either expressed as a ratio to total GDP, or are in growth rates, it is not necessary to convert these variables into a common currency.

Table 4.2: Descriptive Statistics of the macroeconomic variables (EAC: 1994-2005)[26]

	GDP growth	Government expenditure	Trade (openness)	Inflation	Investment to GDP	Labor force growth	Credit to private sector
Mean	4.6	13	45.6	8.9	0.17	2.6	0.12
Standard Deviation	2.1	2.9	11	7.9	0.03	0.5	0.1
Median	4.7	13	43	6.4	0.17	2.5	0.06
Maximum	10.5	17.7	71.7	37	0.25	3.5	0.32
Minimum	0.4	7.7	27.8	-2	0.13	1.6	0.03
Observations	36	36	36	36	36	36	36

Table 4.3 represents the summary descriptive statistics of the variables used to estimate savings function and capital productivity equation with the aim of testing the channels of transmission. IOCR is computed as a ratio of current GDP divided by real value of previous gross fixed capital formation. We use previous period capital stock because essentially current output is mostly a result of past investments. The real values were

[26] These are aggregate data for the entire region

arrived at by deflating the series by the GDP deflator. K is the total stock of capital measures as gross capital formation in Millions of US dollars. The data were obtained from the Bank of Tanzania's *Economic and Operations Report* (various issues), Bank of Kenya's *Annual Report* (various issues), and Bank of Uganda's *Annual Report* (various issues). FDI is the inward foreign direct investment stock as percentage of GDP and was obtained from UNCTAD database http://www.unctad.org/Templates/Page.asp?intItemID=3277&lang=1). ERD is the value of high-technology exports divided by GDP. The value of high-tech exports was obtained from the World Bank's *World Development Indicators* data base. SAVINGS is the private savings measured as time and savings deposits, while INT is the rate of savings. GPDI is gross private disposable income proxied by per capita GNP. Data on SAVINGS, INT and GPDI were obtained form Monetary Fund's *International Financial Statistics (*various issues).

Table 4.3: Descriptive statistics of the variables used to estimate channels of transmission

	IOCR	FDI	K	ERD	GPDI($ millions)	INT	SAVINGS ($ Millions)
Mean	57.9	17.2	1474.9	0.00073	7526.3	6.1	1856.4
Std. Dev.	64.7	13.9	374.9	0.00075	5233.6	5.5	1775.5
Median	36.8	10.2	1443.0	0.0004	5684.5	4.0	871.0
Maximum	316	54.4	2307.2	0.0026	16253.0	24.0	6270.0
Minimum	2.2	3.0	778.3	0.0	2093.0	1.2	214.0
Observations	36	36	36	36	36	36	36

CHAPTER FIVE

Empirical results

5.1 Analysis of Bank Efficiency Scores

In this chapter, we present and analyze the empirical results of the models specified in chapter four. To generate the efficiency scores for each country, the DEAP programming software was used to run the following output oriented DEA model.

$$Maximize \quad \Theta = \frac{U_1 LOANS_i + U_2 SECURITIES_i}{V_1 CAPITAL_i + V_2 LABOR_i + V_3 DEPOSITS_i} \tag{28'}$$

Subject to

$$\text{DMU}_1 \quad \frac{U_1 LOANS_1 + U_2 SECURITIES_1}{V_1 CAPITAL_1 + V_2 LABOR_1 + V_3 DEPOSITS_1} \leq 1$$

$$\text{DMU}_2 \quad \frac{U_1 LOANS_2 + U_2 SECURITIES_2}{V_1 CAPITAL_2 + V_2 LABOR_2 + V_3 DEPOSITS_2} \leq 1$$

$$\text{DMU}_N \quad \frac{U_1 LOANS_N + U_2 SECURITIES_N}{V_1 CAPITAL_N + V_2 LABOR_N + V_3 DEPOSITS_N} \leq 1$$

Where: all the variables are as defined in chapter four

Table 5.1 presents a summary of technical efficiency scores under both constant returns to scale (CRS TE) and variable returns to scale (VRS TE). Scale efficiency scores are also calculated as the ratio of CRS TE to the VRS TE (see Tim Coelli, 1998). Several observations can be made from table 5.1: First, the financial sectors in the three countries have experienced variations in efficiency scores over the sample period. For example,

the VRS TE scores have ranged between 0.82 and .98 for Kenya, and between 0.85 and 0.99 for Tanzania while for Uganda the ranges are between 0.83 and 1. Second, the table shows that the banking systems in the region have become increasingly more efficient in the last few years of the sample. This trend is more pronounced in Uganda and Tanzania. We attribute this trend to two factors: First is the result of the far-reaching financial reforms embarked upon in the first half of the 1990s. Secondly, the efficient improvement may also be attributed to increased competitive pressure in the banking sector resulting from the formation of East African Community in 1999.

Table 5.1: Banking sector efficiency scores 1994-2005: Summary of DEAP results

	Uganda			Tanzania			Kenya		
	CRS technical Efficiency[27]	VRS technical Efficiency[28]	Scale efficiency	CRS technical efficiency	VRS technical efficiency	Scale efficiency	CRS technical efficiency	VRS technical efficiency	Scale Efficiency
1994	0.71	0.84	0.85	0.79	0.85	0.93	0.88	0.91	0.96
1995	0.77	0.85	0.91	0.81	0.85	0.95	0.88	0.96	0.91
1996	0.81	0.83	0.98	0.81	0.86	0.94	0.89	0.91	0.98
1997	0.85	0.87	0.98	0.84	0.89	0.94	0.90	0.91	0.99
1998	0.96	0.99	0.97	0.86	0.91	0.95	0.86	0.87	0.99
1999	0.97	0.99	0.97	0.92	0.96	0.96	0.79	0.82	0.96
2000	0.96	0.98	0.98	0.95	0.97	0.98	0.81	0.83	0.98
2001	0.98	0.99	0.99	0.96	0.98	0.98	0.84	0.87	0.97
2002	0.98	0.99	0.99	0.96	0.98	0.98	0.94	0.97	0.97
2003	0.98	0.99	0.99	0.97	0.98	0.99	0.97	0.98	0.99
2004	0.97	0.99	0.98	0.97	0.98	0.99	0.97	0.97	1.00
2005	0.98	1.00	0.98	0.98	0.99	0.99	0.97	0.98	0.99
Mean	0.91	0.94	0.96	0.90	0.93	0.96	0.89	0.91	0.97

[27] The CRS TE provides overall efficiency, which includes scale efficiency
[28] The VRS TE provides pure technical efficiency, which excludes scale efficiency

The third observation that can be made from table 5.1 is that scale inefficiency is relatively lower for Kenya as compared to those of Uganda and Tanzania. The average scale efficiency measured about 97 percent in Kenya and about 96 percent for Uganda and Tanzania. This means that the banking system in Kenya could on average increase output by about 3 percent if all banks operated at optimal scale, while those in Tanzania and Uganda could increase the same by approximately 4 percent. This may be a reflection of the fact that the size of Kenyan banking system is the largest in the region, and therefore, there is little room left for economies of scale. Also in all three counties, pure technical inefficiencies are much higher than scale inefficiencies. The average pure technical efficiency is 91 percent for Kenya while for Uganda and Tanzania is 94 and 93 percent respectively. Since the value of 100 percent would mean that actual outputs equal to the maximum feasible outputs given the level of inputs, these results suggests that on average the banking system in Kenya can increase the level of output by approximately 9 percent with the same level of inputs. The corresponding levels for Tanzania and Uganda are 6 and 7 percent respectively.

Fourthly, the overall technical efficiency scores are less than scale and pure technical efficiency scores in all three countries, while pure technical efficiency scores are less than scale efficiency scores. This implies therefore, that the major source of overall technical inefficiency is pure technical inefficiency and not scale inefficiency. This finding of the relative importance of pure technical inefficiency is similar to the conclusion reached by Ally *et al* (1990) for U.S.A. banks and Fukuyama (1993) for Japanese commercial banks.

Finally, our results suggest that Ugandan banking system is technically more efficient compared to that of Kenya and Tanzania. Also the results show that Kenyan banking system is the least efficient in the region. At glance this result is puzzling. The Kenyan financial sector is considered one among the most developed financial sectors in the continent. The sector has remained open to the foreign banks entry since independence in early 1960s, while in Tanzania and Uganda, foreign and private banks were not allowed prior to reforms which began in early 1990s. This suggests that the Kenyan banking system has been subject to competitive pressure long before those of the other two countries. Also as mentioned before, in terms of size, the Kenyan banking sector by far, outweighs those of Tanzania and Uganda. The finding that Kenyan banks are comparatively less efficient than those of Tanzania and Uganda could therefore be considered counterintuitive.

However, the finding is consistent with previous findings. A study by IMF (2005a) established that the profit margin, after accounting for overhead costs and loans loss provision is about 6.2 percent in Kenyan banking sector while the same was about 2 percent for Tanzania and Uganda. Since profit margins typically reflect the intensity of competition[29], the study concluded that the intensity of competition in the banking sectors was very small for Kenya and relatively high in Uganda and Tanzania. Also the study noted that *"The lack of competition [*in Kenyan banking sector*] is mainly caused by the presence of many weak banks, which are not able to exert competitive pressure on the few stronger banks, and by deficiencies in the legal infrastructure. This leads to a reputational bias against small banks, since many small banks are fragile and weak.*

[29] Relatively higher profit margins are symptoms of deficiencies in competitiveness

Given that the state-owned banks are not profit-oriented, competition is effectively limited to international banks. As a result, the international banks are largely insulated from more vigorous competition by their size, reputation for deposit safety, extensive local branch networks, and international links. Competition is mostly limited to the top tier corporate clients, while most other customers in Kenya are often effectively tied to one bank, with very high switching costs" [pg 19].

Also the relatively high technical efficiency scores for the Ugandan banking sector reported in our study, is consistent with a study by IMF (2005b) which estimate average efficiency scores of between a minimum of 95 percent and maximum of 100 percent with overall mean of 99 percent for the period 1999 to 2004. The study noted that the generally high efficiency scores are a result of privatization of dominant state owned banks and strengthening of the regulatory and supervision framework. Our efficiency scores for Ugandan banking sector are however, lower than those obtained by the IMF study. This may be due to the difference in the sample periods covered by the two studies.

5.2 Bank Efficiency and Economic Growth – Empirical Evidence

5.2.1 Hypothesis Testing

This section provides empirical evidence on the impact of bank efficiency on economic growth using panel data estimation techniques. We first endeavor to undertake tests of panel data models in order to determine the model that best fits our data. There are three basic methods of panel data estimation namely pooled Ordinary Least Squares (OLS), Fixed Effects model (FEM), and Random Effects model (also known as Error-Component Model-ECM). The first technique combines all the time series and cross-section data and estimates the underlying model by ordinary least squares (OLS). The assumptions underlying the disturbance term for pooled OLS are that it is normally distributed with zero mean and constant variance. However, this technique does not impose strict exogeneity of the variables and the error term across all individuals and over all time periods. Fixed Effect model (FEM) on the other hand, helps minimize the omitted variables problem of cross – section analysis by introducing dummy variables that allow the intercept terms to vary across cross section-units, adding more information to the model.

To decide between pooled OLS (restricted model) and FEM (unrestricted model) estimation techniques, we perform F-test to determine significance of the country specific coefficients in the unrestricted model relative to restricted model. The restricted model specified over all time periods (T) and all countries (N) is specified as

$$Y_{it} = \alpha + \beta EFFIN_{it} + \lambda X_{it} + U_{it} \qquad \text{for i = 1---N and t = 1-----T ;} \qquad (40)$$

where Y_{it} is the GDP growth rate, $EFFIN_{it}$ is the measure of bank efficiency and X_{it} represent a vector of conditioning variables to control for other factors associated with economic growth. α is the common constant for all countries , β and λ are the coefficients to be estimated. On the other hand, the unrestricted model is specified as

$$Y_{it} = \alpha_i + \beta EFFIN_{it} + \lambda X_{it} + U_{it} \qquad \text{for i = 1---N and t = 1-----T ;} \qquad (41)$$

where the intercept with subscript *i* suggests that the constant term for each country may be different due to specific features for each country. In order to allow the intercept to vary for each country, we introduce differential intercept dummies so that equation (38) becomes:

$$Y_{it} = \alpha + \beta_1 DT + \beta_2 DK + \beta_3 EFFIN_{it} + \lambda X_{it} + U_{it} \qquad (42)$$

where DT and DK are dummy variables for Tanzania and Kenya respectively (i.e. DT = 1 if observation belongs to Tanzania, 0 otherwise, and DK = 1 if observation belong to Kenya, 0 otherwise). Since we have three cross-section units, we use two dummies to avoid falling in to the dummy variable trap.

F-test is then given by

$$F = \frac{(SSR_R - SSR_{UR})/m}{SSR_{UR}/(n-k)}$$

where SSR_R is the sum of squared residuals from the restricted model and SSR_{UR} is the sum of squared residuals from the unrestricted model, m is the number of linear restrictions, k is the number of parameters in the unrestricted regression and n is the number of observations. The null hypothesis is that constant terms are all equal against an alternative hypothesis that intercepts varies for each country.

i.e. HO: $\alpha = \beta_1 = \beta_2$

HA: $\alpha \neq \beta_1 \neq \beta_2$

The F-test produced an F statistic of 25.25, which at 95 percent level of the F-distribution with 2 and 31 degrees of freedom, rejects null hypothesis that intercepts are all the same in the three countries. The results therefore suggest that FEM, incorporating country specific effects is a better model. We do not conduct a test to compare FEM and random effect model because our data do not fit random effect model[30]. Wachtel (2001) criticizes the use of country fixed effect model to determine causality between the financial sector and economic growth. He argues that fixed effects dominate the equation since the differences in the level of financial sectors are larger between countries than over time. However, in the case of East African economies, this is not the case. After embarking on financial sector reforms in early 1990s the banking sectors in these countries developed quickly and the level of financial development have changed substantially over time. Therefore, the panel estimation is done using fixed effect model with the dummy variables to account for country specific effects.

[30] Random effect model requires that the number of cross section units be greater than the number of variables included in the model, which is not the case with out data.

To test the hypotheses stated in section 1.7 in order to determine whether or not the GDP growth is related at all to the explanatory variables included in our model, we formulate a null hypothesis (HO) that each slope coefficient is zero against an alternative hypothesis (HA) that the slope coefficients are different from zero. That is HO: $\beta_i = 0$ against HA: $\beta_i \neq 0$ where, β_i is the i^{th} slope coefficient. The t-statistics is computed by using the following formula:

$t_k = \dfrac{\hat{\beta}_i}{se(\hat{\beta}_i)} - 0$ where $\hat{\beta}_i$ is the i^{th} estimated slope coefficients and $se(\hat{\beta}_i)$ is the standard error of the i^{th} estimated slope coefficient. The computed t-value is then compared to the critical value of the t-statistics obtained from the t-distribution table with the appropriate levels of significance and degrees of freedom. Based on the t-distribution table, for degrees of freedom of about 20 or more, a computed t-value in excess of 2 in absolute terms is statistically significant at the 5 percent level, implying rejection of null hypothesis[31]. Since in this study, the degrees of freedom is higher than 20[32], then the null hypothesis that $\beta_i = 0$ is rejected whenever the value of t-statistics (shown in the parenthesis) is 2 or higher in absolute terms.

Table 5.2 below presents a summary of the tests of hypotheses for coefficients of the explanatory variables in the growth model, saving function and capital productivity function respectively.

[31] This is referred to as "2-t" rule of thumb (see Gujarati ,2002)
[32] Degrees of freedom is given by (N-K), where N is the number of observations and K is the number of explanatory variables

Table 5.2: Test of hypotheses for coefficients of the explanatory variables

(a) Growth model

Variables	Coefficient	Null Hypothesis	Computed t-statistics $\frac{\hat{B}_i - Ho}{Se(\hat{B}_i)}$	Critical t-value ($\alpha = 10$ percent)[33]	Decision
Bank efficiency (EFFIN)	ψ	$\psi = 0$	2.272	1.7	Reject
Credit to private sector (CREDIT)	θ	$\theta = 0$	3.169	1.7	Reject
Interaction term (EFFIN*CREDIT)	ξ	$\xi = 0$	4.451	1.7	Reject
Investment rate (k)	α	$\alpha = 0$	5.542	1.7	Reject
Population growth (l)	β	$\beta = 0$	-1.285	1.7	Accept
Government spending (EXP)	Ω	$\Omega = 0$	-1.104	1.7	Accept
Inflation (INF)	γ	$\gamma = 0$	-1.443	1.7	Accept
TRADE	δ	$\delta = 0$	3.207	1.7	Reject

(b) Savings function

Variables	Coefficient	Hypothesis	Computed t-statistics $\frac{\hat{B}_i - Ho}{Se(\hat{B}_i)}$	Critical t-value ($\alpha = 10$ percent)	Decision
Savings rate (INT)	β_1	$\beta_1 = 0$	2.26	1.69	Reject
Gross private disposable income (GPDI)	β_2	$\beta_2 = 0$	1.9	1.69	Reject
Inflation (INF)	β_3	$\beta_3 = 0$	5.6	1.69	Reject
Bank efficiency (EFFIN)	β_4	$\beta_4 = 0$	3.37	1.69	Reject

[33] Critical t-values were obtained from Appendix D of Gujarati (2002) assuming 10 percent level of significance

(c) Capital productivity function

Variables	Coefficient	Hypothesis	Computed t-statistics $\frac{\hat{B}_i - Ho}{\hat{Se}(B_i)}$	Critical t-value ($\alpha = 10$ percent)	Decision
Stock of capital (K)	β_1	$\beta_1 = 0$	2.23	1.69	Reject
Bank efficiency (EFFIN)	β_2	$\beta_2 = 0$	-0.64	1.69	Reject
Expenditure on R&D (ERD)	β_3	$\beta_3 = 0$	1.8	1.69	Reject
Foreign Direct Investment (FDI)	β_4	$\beta_4 = 0$	2.38	1.69	Reject

5.2.2 Regression Results

The results of empirical analysis are setout in tables 5.3 and 5.4, which give the estimates of the coefficients associated with the main explanatory variables of the growth model. In order to facilitate reading, the coefficients of country dummies have been omitted. All exogenous variables were lagged one year to reflect the assertion that the present value of GDP growth depends on the past values of bank efficiency indicators as well as other macroeconomic variables. Moreover lagging exogenous variables may also help mitigate the potential endogeneity problem. We estimate a total of seven regressions with various forms of the specifications in order to check the robustness of the findings.

Regression 1 in table 5.3 analyzes the relationship between bank efficiency and economic growth by regressing real GDP growth against bank efficiency variable (EFFIN) and country dummies but excluding other variables. Regression 2 includes EFFIN, CREDIT and country dummies but exclude the interaction effect between bank efficiency and bank credit to private sector and control variables. Regression 3 adds interaction term

(EFFIN*CREDIT) while regression 4 adds control variables, namely, investment rate, labor force, government spending, inflation and trade. Regressions 1 to 3 in table 5.4 are identical to those in table 5.3, except that bank efficiency variable is replaced by variable MARGIN which is the commercial banks' interest rate spread. As argued in chapter 4, this variable has been widely used as an alternative measure of commercial bank efficiency.

Table 5.3: Fixed Effect Model estimation of growth model

Variable	*Reg1*	*Reg2*	*Reg3*	*Reg4*
Constant	*6.142****	*0.272****	*0.156****	*3.020****
	(3.25)	*(7.358)*	*(0.139)*	*(5.550)*
EFFIN	*0.617****	*0.227****	*0.106****	*0.051***
	(3.74)	*(6.313)*	*(2.761)*	*(2.272)*
CREDIT		*1.073****	*0.317)****	*0.89****
		(3.821)	*(3.917)*	*(3.169)*
*EFFIN*CREDIT*			*0.717****	*0.087****
			(5.564)	*(4.451)*
Investment rate				*0.019****
				(5.542)
Population				*-0.262*
growth				*(-1.285)*
Government				*0.108*
spending				*(-1.104)*
Inflation				*-0.031*
				(-1.443)
Trade				*0.465****
				(3.207)
Adjusted R^2	*0.96*	*0.97*	*0.98*	*0.99*
Durbin-Watson Stat	*1.8*	*1.7*	*1.7*	*1.8*

Country dummies are included but are not shown in the table.
EFFIN*CREDIT is the interaction between average bank efficiency and credit to the private sector.
*, **, *** indicate significance at 10%, 5%, and 1% levels, respectively.
t- Statistics are shown in the parentheses

In Table 5.3, estimated coefficients on efficiency variable (EFFIN) are positive and statistically significant at the 5 percent level or better in all 4 cases, consistent with the hypothesis that countries with relatively efficient commercial banks have greater GDP growth, *ceteris perbus*. The estimated coefficients on the interaction term EFFIN*CREDIT are also positive in all cases in which they appear and are statistically significant at 1 percent level of significance. This is consistent with the hypothesis that bank credit extended to the private sector by relatively more efficient banks will have greater marginal benefits. This finding suggests that banking system efficiency is one of the preconditions for credit to have positive and significant impact on economic growth.

The variable CREDIT which is commercial banks' credit to the private sector is also statistically significant and it bears the expected sign in all regressions in which it appears. This is in line with our hypothesis that credit allocation to the private sector has both a statistically and economically positive impact on economic growth. Previous empirical studies have also shown that credit to the private sector is important to economic growth. See for example studies by Beck and Levine (2001), Bencivenga, Smith and Starr (1996), Levine and Zervos (1998). However, a study by Tuuli Koivu (2002) found that the amount of credit allocated to the private sector is negatively associated with the rate of economic growth in Latin America countries. The author interpreted these results in the light of soft budget constraint phenomenon which is prevalent in those countries. He argued that lending to enterprises applying soft budget constraints may have resulted in counterproductive investments. He also linked the

negative coefficient of credit to the private sector to a number of banking crises that these countries experienced in the 1990s.

We evaluate the economic significance of these findings based on the most complete specification shown in regression 4 of table 5.3. Since we used logarithmic functional form, the regression coefficients can be interpreted as elasticities. Hence the estimated coefficient of CREDIT in regression 4 predicts that a 10 percent exogenous increase on bank credit allocated to the private sector would increase annual GDP growth by about one percentage point. With respect to the estimated coefficient of bank efficiency variable, a 10 percent increase in banking system efficiency is predicted to increase GDP growth by about half of one percentage point. Although the magnitude of the marginal effects of bank and credit to the private sector seems small (05% and 1%) we argue that, these effects are economically significant when evaluated in the light of mean GDP growth during the period under analysis. For example, for the period of 12 years (1994 – 2005) the Kenyan GDP growth mean was about 3 percent. Obviously an increase of 0.5 percent in one year is economically significant.

Regarding other explanatory variables, inflation (INF) and government spending (GOV) appears to have no significant impact on economic growth. Population growth rate which is a proxy for labor force growth is also insignificant and has a wrong sign. This finding contradicts earlier findings by Barro (1991), Levine (1997) and Levine and Zervos (1998). We argue that population may not be a good measure for labor force growth in East African region since these countries are experiencing very high rates of

unemployment . Probably data on actual labor force employed in various sectors such as manufacturing, agriculture, mining etc. would have yielded more robust results. However such disaggregate data is not available.

Growth rate of investment which is a proxy for growth in physical capital is statistically significant at one percent level with a positive sign in line with our expectations. Also imports and exports as a share of GDP (TRADE) which is a measure of trade or openness is positive and significant at one percent level confirming a positive link between international trade and economic growth as hypothesized. While this outcome contradicts that of Rodrick (1999), it is in line with those of Becks and Levine (2001). Also Dollar and Kraay (2001) found evidence of a positive link between trade and economic growth for Sub-Saharan Africa during 1990 to 1996.

In table 5.4 we replace the variable EFFIN with an alternative measure of banking system efficiency, MARGIN, which is the spread between lending and deposit interest rates of the commercial banks. As expected the variable MARGIN is negatively and significantly associated with economic growth as it appears in regression 1 of table 5.4. This result does not change significantly when CREDIT variable and other control variables are added in the model (reg. 2 and reg.3). In all cases the variable MARGIN is negative and statistically significant at the 10 percent level or better. The results are in line with our hypothesis that a shrinking interest rate margin (a measure of efficiency of financial sector) promotes economic growth. Tuuli Koivu (2002) found similar results for 25 transition countries during the period 1993 to 2000.

The findings are also supported by the theoretical framework presented in Pagano (1993) which predicts that an efficient banking sector decreases intermediation costs by reducing leakage of financial resources that is absorbed by banks as the spread between lending and deposit rates. Thus the share of savings allocated to the investments increases and leads to higher economic growth.

Table 5.4: Fixed Effect model estimation of growth model

Variable	*Reg1*	*Reg2*	*Reg3*	*Reg4*
Constant	*5.952****	*4.942****	*4.368****	*-0.931*
	(12.8)	*(21.8)*	*(7.112)*	*(-0.52)*
MARGIN	*-0.465***	*-0.163**	*-0.197****	
	(-2.463)	*(-1.99)*	*(-5.03)*	
EFFIN				*0.87***
				(2.67)
CREDIT		*0.156***	*0.264**	*0.44****
		(2.261)	*(1.9)*	*(3.12)*
Investment rate			*0.351*	
			(0.186)	
Population			*-0.268*	
growth			*(-0.81)*	
Government			*0.292*	
spending			*(1.665)*	
Inflation			*-0.079*	*-0.386**
			*(-2.175)***	*(-1.9)*
Trade			*0.232*	*0.72****
			(1.092)	*(4.56)*
SAVINGS				*0.0001****
				(4.56)
IOCR				*1.113****
				(3.38)
Adjusted R^2	*0.80*	*0.92*	*0.97*	*0.93*
Durbin-Watson Stat	*2.3*	*2.07*	*1.9*	*1.6*

Country dummies are included but are not shown in the table.
*, **, *** indicate significance at 10%, 5%, and 1% levels, respectively.
t-statistics are shown in the parentheses

5.2.3 Analysis of the Transmission Mechanism Results

Regression 4 in table 5.4 represents the regression results of the growth model with savings and IOCR as additional explanatory variables. In order to spare the degrees of freedom, we drop some of the control variables which were statistically insignificant in the main regression. Also investment was dropped because of high colinearity with savings. As the table shows, the estimated coefficients of savings and IOCR are all statistically significant and positive as expected. The results suggest that a 10 percent increase in the incremental output to capital ratio, which is a measure of capital productivity, will increase the GDP growth rate by about 11 percent. The coefficient of the bank efficiency variable remained positive and statistically significant, at the 5 percent level.

In table 5.5 we present regression results for the saving function with efficiency scores as one of the explanatory variable. The regression presented in column one of the table display very poor results. The results indicate that, with exception of the inflation rate, all the exogenous variables have the correct signs as predicted by the theory. However, three out of the four explanatory variables are found to be statistically insignificant. Also the Durbin-Watson statistics is very low (about 0.2). To make sure that the model does not violate the classical assumptions, we conducted the test for autocorrelation. From the Durbin-Watson statistical table, we find that the lower and upper critical values of the d-statistics with 36 numbers of observation and 4 explanatory variables are 1.236 and 1.724 respectively. Since the estimated value of D-W (0.2) lies below the lower critical value of 1.236, we can not reject the hypothesis that there is positive autocorrelation in the

residuals. We correct for autocorrelation by running pooled Generalized Least Squares (GLS) regression and the results are presented in column 2. The GLS results show a significant improvement. Adjusted R-squared increased from 0.75 to 0.989, while D-W rose from 0.19 to 1.83. Except for the coefficient of inflation rate, all the exogenous variables exhibit the correct signs as predicted by the theory. Also the coefficients of the interest rate and per capita GNP are statistically significant at lest at the 10 percent level of significance. This indicates that increases on deposit rates and per capita GNP may have a significant positive impact on saving mobilization. More importantly for our study, the efficiency variable (EFFIN) is positive and statistically significant at the 5 percent level of significance. The results suggest that a 10 percent increase in the bank efficiency would increase the volume of savings by about 9.6 percentage points.

Table 5.5: Regression results for the savings function

Variable	Reg1	Reg2
Constant	-2.6 (-1.6)	-1.7*** (-2.9)
EFFIN	2.304 (1.5)	0.96** (2.26)
INT	-0.193 (-1.3)	0.09* (1.9)
INF	3.23 (1.5)	0.08*** (3.37)
GPDI	1.175*** (9.5)	5.57*** (5.6)
AR(1)		0.14*** (10.96)
Adjusted R^2	0.75	0.99
DW-stats.	0.19	1.8

*, **, *** indicate significance at 10%, 5%, and 1% levels, respectively.
t-statistics are shown in the parentheses

Table 5.6 reports the results of estimating capital productivity equation to examine the effects of bank efficiency variable on the average productivity of capital stock, while conditioning on other variables which, are suggested by the economic theory and literature to have influence on productivity of capital. The results presented in table 5.6 show that the coefficient of the capital stock is not statistically significant at the conventional levels. This suggests the presence of constant returns to scale to capital stock, which, in itself provides support to the endogenous growth hypothesis. The coefficient of the foreign direct investment is positive and statistically significant at the 1 percent level, suggesting that foreign entrepreneurs have a positive impact on the average productivity of capital stock. More importantly for our study, the results in table 5.6 show that bank efficiency variable (EFFIN) has the correct sign and is statistically significantly correlated with productivity of capital (IOCR) at the 5 percent level of significance. The results suggest that a 10 percent increase in commercial bank efficiency would increase capital productivity by about 1 percentage point. Taken together, these results support our hypothesized channels of transmission that improved bank efficiency promotes economic growth by influencing the productivity of capital and increasing the levels of savings.

Table 5.6: Regression results for the capital productivity (IOCR) function

Variable	Reg1
Constant	0.446 (0.67)
EFFIN	0.103** (2.23)
K	-0.62 (-0.64)
FDI	2.38*** (4.91)
ERD	0.402 (1.8)
Adjusted R^2	0.54
DW-stats.	1.4

*, **, *** indicate significance at 10%, 5%, and 1% levels, respectively.
t-statistics are shown in the parentheses

Generally our empirical findings suggest that the banking systems in the EAC countries influence economic growth through various channels. Specifically the findings confirm that financial sectors impact economic growth not only through capital accumulations as argued by among others, McKinnon and Shaw (1973) but also through the degree of banking efficiency in a particular country. Casual observation of table 5.7 supports our empirical findings on this account. As the table show, Uganda which has the highest average bank efficiency, also has the highest average GDP growth, while Kenya with the lowest average bank efficiency, has the lowest average GDP growth over the sample period.

Table 5.7 Average GDP growth rate and average commercial banks technical efficiency for EAC countries: 1994-2005

Country	Average GDP growth	Average bank efficiency
Uganda	6.1	0.94
Tanzania	4.7	0.93
Kenya	2.9	0.91

Source:
1. GDP growth rate: Various publications of EAC countries central banks
2. Average bank efficiency: Own calculations

CHAPTER SIX

SUMMARY, POLICY RECOMMENDATIONS AND FUTURE RESEARCH

6.1 Summary of the Results

The broad objective of this dissertation was to investigate the role of financial systems development in the economic growth of the East African countries. We concentrate on banking sectors as they typically have dominated financial intermediation in these countries. We emphasized the importance of both the qualitative and the quantitative aspects of the banking sectors. The qualitative aspects of the banking sectors were measured by the commercial banks' efficiency, while the quantitative aspects were measured by the volume of credit extended to the private sector by commercial banks. We first examined the evidence concerning the efficiencies of commercial banks in each of the three countries and then test the effects of these efficiencies on economic growth. We also investigate two potential transmission mechanisms.

A Data Envelopment Analysis (DEA) model was used to generate bank efficiencies under both cases of constant and variable returns to scale. The choice of DEA model instead of Stochastic Frontier Analysis (SFA) model was due to lack of high quality and reliable data. Also unlike Stochastic Frontier which requires a large size sample, DEA can work just fine with small sample size.

On the other hand we used a fixed-effects panel model to investigate the empirical relationships between bank efficiency and economic growth. The analysis was based on the equation relating the GDP growth to bank efficiency scores as one of the independent variables among others used to control for other factors affecting growth. Two possible transmission mechanisms from financial development to economic growth were hypothesized. One is through improved capital productivity resulting from the ability of more efficient banks to channel available funds to the most productive users. The second is through increased volume of capital and therefore investment. The two hypothesized potential transmission mechanisms were tested by estimating two separate equations, one for capital productivity and another for savings function, to ascertain whether variations in these variables can be explained by variations in banking sector efficiency.

The results on commercial banks' efficiency indicate the following: First, the financial sectors in the three countries have experienced significant variations in their commercial bank efficiencies over the sample period. The banks have become increasingly more efficient over time. On the other hand, there are no significant differences in banking sector efficiencies across the three countries. However, the results suggest that Uganda has the most efficient banking sector while Kenyan banking sector is the least efficient. This suggests that Ugandan banks are in the best position to expand in the future common East African banking market. Secondly, the results indicate that in all three countries, banks suffer more from technical inefficiencies than scale inefficiencies. Scale inefficiencies are however, relatively higher for Tanzania and Ugandan banks as compared to Kenyan banks.

Meanwhile, the results for panel data regression on the relationship between bank efficiency and economic growth are consistent with the hypothesis that relatively efficient banking sectors are associated with faster economic growth. The banking system efficiency variable was positive and statistically significant for all specifications considered. The relationship between commercial banks' efficiency and economic growth remained robust even with inclusion and exclusion of other potential determinants of economic growth. The variable CREDIT, which is the commercial banks' credit to the private sector, was also statistically significant with the expected positive sign, indicating that the credit allocated to the private sector by commercial banks has a positive impact on economic growth.

The coefficient of the interaction term between credit to private sector and bank efficiency variables was also positive and statistically significant in all regressions in which it appears, consistent with the hypothesis that credit extended to the private sector by relatively more efficient banks will have greater marginal benefits. We tried to replace the bank efficiency variable with an alternative measure of banking system efficiency in order to check the robustness of our results. The alternative measure used is the spread between lending and deposit rates of commercial banks. The coefficient of this alternative variable was negative and statistically significant in line with the hypothesis that a shrinking gap between the lending and deposit rates has a positive impact on economic growth.

Some of the coefficients of the control variables, namely, human capital, inflation and government spending do not display particular significant relationship with economic growth. However, the coefficients of other control variables were found to have the expected signs and were statistically significant.

Also the data provide support for the two hypothesized transmission mechanisms from commercial banks efficiency to economic growth, namely, through improved capital productivity and through increased volume of savings. To examine these mechanisms, we tested whether commercial banks efficiency variable (EFFIN) has positive effects on the average productivity of capital and level of savings on one hand, and on the other hand we tested whether these intermediate variables have positive effects on GDP growth. The empirical results confirm that commercial banks' efficiency is positively associated with both the average capital productivity and level of savings. In addition, the results suggest that these intermediate variables are positively and statistically related to GDP growth.

In a nutshell, this dissertation contribute to the finance-growth literature by examining the impact of commercial banks' efficiency on economic growth and investigating potential mechanisms through which variations in the banking system may be transmitted in to economic growth. The empirical findings point out to the existence of an independent effects exerted by bank efficiency on real growth and that bank efficiency affects real sector mainly through productivity improvement or an increase in the level of savings.

6.2 Policy Recommendation

This study has had to contend with low quality of data that is presently inevitable in most developing countries, especially those in Sub-Saharan Africa. We were also limited or constrained in extending our sample period as far as we would wish, due to unavailability of adequate commercial banks' data. However, not withstanding these limitations, we hope that the study has shed some light on a number of policy issues. The empirical findings of this study provide some useful steps in understanding the link between financial sector and economic growth. In particular, the study suggests that banking sector efficiency plays an independent role in promoting economic growth in the East African region. The implication of this finding is that future studies linking financial sector and economic growth should emphasize the importance of both the size and the quality (efficiency) aspects of the financial sectors. As mentioned earlier, the existing literature on the subject has focused attention on impact of increased volume of financial services on the economic growth. The importance of quality of financial services has so far been ignored.

Another important policy implication of this study is that governments in the East African region can help promote economic growth by adopting policies that encourage efficient financial sectors. The study reveals that opening the banking sectors to foreigners and privatizing the state owned banks do not necessarily lead to efficient banking systems. Much more reform measures are needed along with liberalization and privatization in order to achieve the desired efficiency in the financial sectors. Such reforms may include resolving the problems of weak banks, improving the legal

frameworks and enabling information sharing among financial institutions on creditworthiness of borrowers. These measures would help reduce operating costs and also encourage competition in the banking sectors. To the extent that competition forces banks to operate more efficiently, this study calls for, among others, a need for the governments in the region to put in place policies that may reduce the dependence of banks upon government securities as a source of low-risk, high-yielding assets[34]. This could lead to increased competition, as banks would have to identify new lending opportunities and expand their customer base in order to generate income. Efficiency in the banking systems could also be improved by reinforcing technology such as comprehensive computerization of the banking systems. This could enable banks to provide products and services in large volumes at competitive costs with better risk management practices.

6.3 Areas for Future Research

In this study we employed non parametric method, particularly DEA, to generate bank efficiency scores. However, this method has been criticized in that it does not account for any noise in its analysis and so its results may be misleading, especially when the output and/or input patterns are disrupted by factors outside the control of the management such as natural disasters. Furthermore, the DEA is much more of a "black-box" technique – the exact relationship between inputs and outputs is difficult to ascertain or test. Therefore, future research could be done using parametric methods such

[34] As noted in chapter four, the commercial banks in the three countries have strong preference for holding government securities as compared to extending loans.

as Stochastic Frontier Analysis in order to check the robustness of the results obtained in this study.

Although in this study we established the levels of bank efficiency across the East African region, we did not endeavor to investigate the determinants of bank efficiency in the region. It may be interesting to ask the question what factors influence the bank efficiency in the three countries? This is another area where future research may focus.

Also the time period of this study is not long enough to examine the dynamic relationship between bank efficiency and economic growth. A useful extension of this study would therefore be to expand the time period covered in order to better understand the dynamics between the two variables. In addition, the number of countries might also be increased. It will be interesting to see results for a large group of countries and longer time periods.

As previously mentioned, the financial sectors in East African Countries can be termed as bank oriented, with infant capital markets. Thus proxying the contribution of financial sector through the banking sector may be justified on this account. However, it would be useful if future research could include equity markets into the growth model. Although the equity markets are still underdeveloped and their financing role is limited, nonetheless, it would be interesting to examine their role in economic growth.

Along with this study, previous studies have found that the correlation between financial development (differently defined) and economic growth is uniquely robust (Levine and Zervos, 1993). Nonetheless, correlation does not necessarily imply causation. Finance-

growth literature identifies two possible directions of causality between financial development and economic growth. First is the supply *leading hypothesis* due to McKinnon (1973) which posits a causal relationship from financial development to economic growth. According to this hypothesis, a deliberate creation of financial institutions and markets increases supply of financial services and thus leads to real economic growth.

The second is d*emand-following hypothesis* due to Patrick (1966) which postulates a causal relationship from economic growth to financial development. Here, an increasing demand for financial services might induce an expansion in the financial sector as the real economy grows. The current study did not attempt to empirically test the two hypotheses. Future studies could therefore investigate not only the correlation between financial sector development and economic growth, but also causality pattern between the two.

Finally, the study proposed two channels of transmission from financial sector development to economic growth, namely improved capital productivity and increased volume of capital. However, the link between financial sector and real sector may be much more complex than portrayed in this study. Future research should therefore attempt to further examine the channels of relationship between financial sector and economic growth.

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Appendix 1

Summary of the Empirical Review of Financial Sector Development and Economic Growth

Author	Variables		Results
	Economic growth	**Financial development**	
Gregorio and Guidotti (1995)	Real per capita GDP growth	Ratio between bank credit to the private sector and GDP	Positive relationship between financial development and growth, but the impact changes across countries and is negative for Latin America
King and Levine (1993)	Per capita GDP growth Per capita growth rate of physical capital accumulation	The ratio of liquid liabilities of the financial system to GDP The ratio of deposit money bank domestic assets to deposit money bank domestic assets plus central bank domestic assets The ratio of claims on the non-financial private sector to total domestic credit The ratio of claims on the non-financial private sector to GDP	Financial services stimulate economic growth by increasing the rate of capital accumulation and by improving the efficiency, with which the economy use that capital.
Ahmed and Ansari (1998)	Per capita nominal and real GDP	The ratio of M2 to nominal GDP Quasi-money as a percentage of nominal GDP The ratio of domestic credit to nominal GDP	A high degree of association between financial sector development and economic growth Causality tests provide a strong support for the supply leading hypothesis
Choe & Moosa (1999)	Real GDP Gross fixed capital formation	Household sector holdings of securities & equities Household holdings of various deposits in finance Business sector securities & stocks in total financial liabilities Growth of business sector loans	Financial development leads to real growth and financial intermediaries are more important than the capital markets

Odedokum (1996)	Annual growth rate of GDP	Ratio of average nominal value of the stock of the liquid liabilities to the nominal annual GDP	Financial development promote economic growth in about 85% of the 71 countries in the study Growth promoting effects of financial intermediation are invariant across the various regions of the globe
Al-Mashat (2002)	Real GDP growth	Real interest rate The ratio of M2 to GDP Ratio of reserve money to total deposit	Positive relationship between Economic growth and financial sector reforms.
Bolbol et al. (2004)	Total factor productivity	Ratio of domestic credit to the private sector to GDP Ratio of commercial bank assets to the sum of commercial banks and central banks assets Ratio of market capitalization to GDP	Bank related financial development indicators are negatively related to the total factor productivity growth
Andersen S. (2003)	Annual growth in GDP per capita	Liquid liabilities Credit to the private sector Volume of credit provided by banks	Strong and significant relationship between financial sector development and economic growth Strong influence of financial sector development on long term economic growth than on simultaneously growth
Berger et al. (2004)	GDP growth SME employment shares	Total market shares of community banks Weighted average efficiency ranks of community banks	Greater market shares and efficiency ranks of small, private, domestically owned banks are associated with better economic performance.
Andrus O. (2001)	Industrial production index	Ratio of bank credit to the private sector to GDP Ratio of claims on the private sector to domestic credit Ratio of domestic credit issued by deposit banks to domestic credit issued by deposit banks and central bank The wedge between interest rate of the loans and the deposits	Depending on the time period and sub-sample, the correlation of the financial development with economic growth can be negative or positive The causality (in Granger sense) can run one way or the other, depending on the particular country.

Koivu (2002)	Annual GDP growth	The margin between lending and deposit rates The amount of bank credit allocated to the private sector	The presence of efficient banking sector accelerate economic growth in the transition economies The amount of bank credit allocated to the private sector does not speed up economic growth in transition countries The causality runs mostly from economic growth to credit growth

Appendix 2 - Official exchange rate (LCU per US$, period average)

	Kenya	Tanzania	Uganda
1994	56.05058	509.6309	979.4454
1995	51.42983	574.7617	968.9167
1996	57.11487	579.9767	1046.085
1997	58.73184	612.1225	1083.009
1998	60.3667	664.6712	1240.306
1999	70.32622	744.7591	1454.827
2000	76.17554	800.4085	1644.475
2001	78.56319	876.4117	1755.659
2002	78.74914	966.5828	1797.551
2003	75.93557	1038.419	1963.72
2004	79.17387	1089.335	1810.305
2005	75.55411	1140.251	1780.666

Source: World bank's *World Development Indicators* database