ADDIS ABABA UNIVERSITY
SCHOOL OF GRADUATE STUDIES

CAPITAL MOBILITY: THEORY AND EVIDENCE FOR SUB-SAHARAN AFRICAN COUNTRIES

BY
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A THESIS SUBMITTED TO THE SCHOOL OF GRADUATE STUDIES OF ADDIS ABABA UNIVERSITY IN PARTIAL FULFILLMENT OF THE REQUIREMENTS FOR THE DEGREE OF M.SC. IN ECONOMICS

JULY 2006
ADDIS ABABA UNIVERSITY

Addis Ababa University
School of Graduate Studies

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Acknowledgment

I am indebted and most grateful to all the teachers I have had who worked so hard to make me whatever I am now.

I express my sincere gratitude and indebtedness to my advisor Dr. Ch. Paramaiah for his invaluable help in giving direction to my muddle ideas, starting me off with my research, following up my progress throughout the exhilarating but trying experience of producing this M.SC. research paper. I acknowledge and value his competent guidance and unlimited encouragement throughout my thesis work. The illuminating discussion that I have had with him on my occasions have been very helpful. I am deeply grateful to him for providing me helpful suggestions and comments on the manuscripts leading to this thesis.

My special thanks go to Tamirat Workalemahu for cheerful encouragements and considerable help in introducing me to the use of STATA, EVIEWS software's and panel unit root test techniques.

I am greatly indebted to Medhanit Mazengia, Demissaw Tsigemelak, Gutema Balcha, Dr. Dessalegn Chalsisa, Dr. Sileshi Nemomssa, Dr. Teshome W/mariam, Wolde Bulto and Dessalegn Fufa with whom I had the good luck of meeting them and greatly benefiting by it for their valuable advises and substantial assistance.

Financial support from AAU is greatly acknowledged.

Last but definitely not least, I want to thank my parents for lovingly giving their all through out the years. My brother Dessalegn Gurmessa my niece Alemi Hordofa and my nephew Gemechu Shimelis were a great source of inspiration in times of difficulty and doubt.

I can never thank enough Kalkidan Sime for so patiently word processing all the pages of my disorganized manuscript.

Blessed be God for making it all happen
Nemera Gurmessa

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Abstract

In this paper the researcher is primarily concerned with assessing the degree of capital mobility in Sub-Saharan African countries. By applying the methodology as proposed by Feldstein and Horioka (1980), later termed the "Feldstein-Hoioka puzzle", the researcher tests the hypothesis of perfect capital mobility against the alternative of imperfect capital mobility. The provision is made in this model to show the dependency of the lesser developed Sub-Saharan African countries on international finance and aid and how a more open economy contributes towards improving the level of capital movement in these countries. The researcher also assess the change in the degree of capital mobility over the time period in an effort to test whether institutional and political changes have been successful or not.

Stationary panel data estimation techniques are applied for the sample of 25 Sub-Saharan African countries over the time period 1988-2003. The benefits of using one-way error component models are derived from simultaneously by employing time and cross-section dimensions of the data, resulting in a substantial increase in the degrees of freedom. The fixed and random effects models enable us to acknowledge country heterogeneity within the panel, making provision for differences across countries like capital control policies, financial and capital market structures and exchange rate regimes.

CHAPTER ONE

INTRODUCTION

1.1. Background of the Study

Sub-Saharan Africa, according to the World Development Indicator (2002) with about 700 million inhabitants for 49 states, is one of the lowest economically developed subcontinents in the world. It represents 10% of the world population and 1.0% of the GDP.

The expansion rate of the effective GDP went from 4.6 percent a year in 1960s, 3.0 percent during the 1970s, 2.1 percent during the 1980s and 2.4 percent during the 1990s (World Development Indicator, 2002). UNDP'S Human Development indicators reveals that the Sub-Saharan African countries are in the poorest development stage of the world. The human development indicator had strongly improved after the independence but during the 1980s an economic downturn has been noticed. Consequently, the life expectancy ratio went from an average of 43 year in 1965 to 50 years in 1982 and it has declined to 49 years in year 1998.

At the heart of the African dilemma is an inexorable economic decline, a drop in per capita incomes, rapid increases in population, the loss of export revenues, the curtailment of foreign investment, the destruction of fragile ecosystems, war and civil strife, and the inability of many countries to feed their people and

meet other basic human needs (Gunnings, J.W, 1999). Between 1980 and 1990, per capita output fell by 42.5%, per capita consumption (a more significant measure of human well-being) fell by 40%, domestic investment declined by 29.7%, exports fell by 34.5%, per capita food production dropped by 12.2%, and the total external debt rose by 162.0% to a level as the region's total GNI (World Bank WDI, 2001 and UNDP, 1992).

After such a calamitous decade, many Africans hoped desperately for a turnaround; outside observers widely predicted that the 1990s would bring renewed development. While signs of renewal appeared for a time, and the experience was not as bad as that of the 1980s, hopes have dimmed. Between 1990 and 2000, GDP rose at a rate of 2.4% per year. But with population growth continuing at an extremely high average annual rate of 2.6%, output per person continued to fall, and with it personal incomes.

From a global perspective, Sub-Saharan Africa has fallen steadily behind the rest of the world. Its share of global GNI dropped from about 2.0% in 1960 to 1.0% in 2000, even though it has 10% of the world's population (World Bank, 1992, 2001). Between 1985 and 2000, its real GDP growth rate consistently lagged behind Asia and Latin America. Its share of global trade fell from 3.8% in 1970 to less than 1.5% in 2000. Steep drops in commodity prices cost the continent more than $80 billion loss in export earnings during 1985-1994. Its share of LDC private direct investment dropped from 25% in 1970 to 4% in 2000 (World Bank 2001).

In general, Sub-Saharan African countries remains marked by:

a. *Inadequate structures:* lack of infrastructures, limitedness of the markets, signs of industrial sectors, weakness of the institutional environment,

b. *Inadequate policies:* the overburden of corruption, mismanagements of the public and private sectors,

c. *International vulnerabilities:* indebtedness, prices of raw materials. It remains a rente economy where enrichment is the result of withholding rather than from the substantial creation of wealth, consequently causing an international marginalization.

Several factors explain the hold up of the accumulation process and why Africa's financial sectors are not very effective in promoting capital mobility, i.e. the transfer of resources (capital) from those who have it (savers) to those who can make use of it (borrowers or investors).

In Africa savings rates have been low and widely fluctuating. There is a clear distinction between the haves and have-nots in terms of resources. Savings reflect resource endowments and very widely with terms of trade shocks. The three richest countries in terms of marketable resources – Botswana, Gabon, and Nigeria all exhibit routine fluctuations of about ten percentage points in their savings rates, with peak fluctuations of 18 to 20 percent (International Monetary Fund, 1992). Such variance puts incredible strains on development

planning and fuels boom and bust cycles, exacerbating the high level of uncertainty and risk characteristic of developing economics.

Conversely, the poorest countries in Africa save less than 10.0% of domestic production and much of whatever capital inflows they can generate. No fewer than thirteen African countries consumed more than 99.0% of their domestic product in at least one year since 1980, leaving themselves totally dependent on foreign assistance to finance their development (World Bank, 1992). Obviously, rain-fed agricultural societies will be heavily dependent on weather; variability in rainfall is thus magnified in the savings rate, since savings is the residual of income minus consumption.

The need to mobilize savings for growth is critical in these countries. Rather than a problem of managing fluctuations it seems to be more a question of creating something out of nothing. Yet, even the poor save, though usually in the form of livestock, land or seed. Often it is a question of how to develop institutions and institutional mechanisms that are trusted by the people to intermediate savings through a financial system. Where capital markets do not work, either through inappropriate policies or due to problems inherent in developing countries (such as high information costs), the expansion of economic activities for all but the largest private sector corporations can be accomplished only through self-finance. An entire economy attempting to finance growth through retained earnings cannot easily restructure or transform itself from an agrarian to manufacturing-based economy.

In many areas of Africa, less than 40 percent of the population has access to a bank [Nzemen, 1989]. According to Nowak (1989), per capita bank credit in the private sector amounts to $48 per annum in Sub-Saharan Africa, but 90 percent of the economic operators have no access to it. Development of banking sector should be a priority for African LDCs.

As it has been noticed (Nzemen, M. 1989) African economics have also developed effective informal financial systems, such as the ***tontines*** of Cameroon, Senegal, Cote d'Ivoire, and Congo, also known as ***esusu*** in Nigeria, ***likelemba*** in Zaire, ***susu*** in Liberia, ***cilimba*** in Zambia, ***chilembas*** in Uganda, and ***ekubs*** in Ethiopia. Tontines form an informal financial market whereby members invest their savings and can obtain credit on a rotating basis. Tontines contributes to the monetarization of the rural economy, channeling otherwise hoarded funds into small-scale investments, which benefit from the collective monitoring by tontine members (Nzemen 1989). Africa's informal financial institutions thus play a vital role in pooling funds and allocating them efficiently in underdeveloped areas.

Actually, informal intermediaries have their limitations: Financial dualism aggravates economic dualism Nowak (1989) there is no substitute for sound development of the formal financial sector.

Africa is the only major region to experience investment and saving per capita decline after 1970. Averaging about 13.0% of GDP in the 1990s, the savings rate of African countries has been the lowest in the world. Estimates of genuine

domestic savings, which capture the effects of resource depletion, are just 3.0% for Africa (World Bank, 2000).

Most Sub-Saharan African countries started to liberalize their economies since 1980s. Despite this liberalization, Africa's financial sectors are not very effective in promoting development. South Africa has one of the deepest, most sophisticated systems outside the developed countries, and Kenya, Mauritius, and Zimbabwe have relatively, well developed systems. But most of the other countries are underdeveloped, mobilizing few resources and providing a limited range of services.

After independence most African governments intervened heavily in their financial sectors, nationalizing banks, setting interest rates, and restricting the allocation of credit. But repressed financial systems failed to mobilize savings. The solvency and capacity of financial institutions were undermined. Non-performing loans rose, and limited avenues for sound savings increased capital flight. In the 1990s reforms sought to correct these problems, emphasizing market liberalization, bank restructuring and privatization, and strong supervision and regulation.

Although financial sectors are stronger than before, the results of reforms have been disappointing. Credit remains costly and mostly short-term, and spreads between lending and deposit rates are high (Collier, P., and J.W. Gunning, 1999). Financial savings have not deepened much relative to GDP. In some countries banks have cut commercial lending in favor of holding government

securities. Competition is still limited and, despite the emergence of about a dozen stock markets, non-bank finance is often hard to come by.

Sub-Saharan African countries need significant aid if they are to achieve the poverty eradication and social goals endorsed by the international community. According to the millennium goal plans, Africa would require investment of 30.0% of GDP to support the high growth needed to reduce poverty by 2015 (Collier P., 1997). In the 1990s saving rates were just 13.0% of GDP, and the experience of other regions suggest that private inflows cannot be sustained at more than 5.0% of GDP without risk of financial instability, that leaves a large savings gap. But given the extent and depth of poverty in Africa, more consumption not less is required for some time. A sharp increase in savings is not expected and may not be desirable. Thus, Africa will need considerable donor support. Thus, the aforementioned considerations pose some fundamental issues to be addressed regarding capital mobility in Sub-Saharan African countries in to date economic era.

1.2. Statement of the Problem

The current purpose of globalization leads to a consolidation of the productive systems, financial markets, commercial and information flows. It is favorable, altogether, to the growth of emerging economies. In spite of certain signs of recovery, Sub-Saharan African countries remains widely on the outside of this recent world's dynamics. This continent is trapped in a poverty cycle leading to a correlated marginalization and a substantial divergence as compared to the

emerging countries. One notices, however, an African Renaissance, expression of the initiative of the New Economic Partnership for the African Development, (NEPAD).

Feldstein, M. and Horioka, C., in 1980 pointed to a high correlation between domestic rates of investment and savings among OECD countries. Some take this as evidence of limited financial integration in the industrialized world. This study shows that this result holds only for OECD countries and vanishes for sample of developing countries.

Based on a longer time period (1988-2003) and a more recent data set than the previous literature, the researcher analyze 25 sub-Saharan African countries for which the strong positive correlation between domestic investment no longer holds. The study estimate a fixed effect regression using panel data (previous study has focused only on cross-country regressions), which also shows a very high correlation of domestic investment and domestic saving for OECD economies and a very low one for any other sample countries.

The dataset used, to the knowledge of the researcher, is the largest used so far. Previously used datasets of similar size have been combinations of industrial and developing countries, whereas this dataset exclusively consists of 25 Sub-Saharan African countries.

Another extension of this study is direct inclusion of foreign aid in the saving investment regression. Because in many developing countries a significant part of investment financing comes from non-market flows, such as foreign aid. To

the extent that foreign aid is important the saving-investment correlation will weaken and the Feldstein-Horioka regression will be mis-specified. As will be shown in the study the regression coefficient of saving on investment indeed increases by including foreign aid in the regression.

It is time, therefore, to rise questions regarding capital mobility which this study will try to answer:

- How will Sub-Saharan African countries be able to positively integrate to the world economy and reinforce their development process?
- Are the measures so far taken by Sub-Saharan African countries adequate enough to mobilize saving, enhance investment and achieve the desired growth rate in the economy?
- Has Sub-Saharan African Investment become more sensitive to current account and Aid?
- What are the factors driving Sub-Saharan African countries saving and investment? How is saving channeled into investment?
- Why is it, in a world in which the observed pattern of capital flows is indicative of a far from globalized reality, that public policy continues to be constructed in line with more extreme variants of globalization hypothesis?
- Has capital mobility emerged in Sub-Saharan African countries?
- How does openness take advantage of international competition?

In studying capital mobility answers to these questions are important for several reasons. First, they inform the current debate on types of risks and policy challenges stemming from Sub-Saharan African countries low investment, including on what policies are needed to mitigate risks and improve the efficiency of capital mobility.

Second, they facilitate the understanding of Sub-Saharan Africa's pattern of growth. Low investment and saving are key features of Sub-Saharan Africa's pattern of growth. A better understanding of their determinants could improve the understanding of the pattern of growth; its sustainability; and medium and long-term prospects.

Third, they help identify the policy implications of the project saving and investment developments, also in light of identified tensions and the intended changes in the policy stance.

In this study, therefore, attempts are made using different data and additional elements of theory. It aims to challenge the empirical contribution. By using a panel of 25 Sub-Saharan countries (Benin, Botswana, Burkina Faso, Burundi, Cameroon, Central African Republic, Cote D'Ivoire, Ethiopia, Gabon, Gambia, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Niger, Nigeria, Rwanda, Senegal, south Africa, Togo, Zambia, Zimbabwe) during 1988-2003, it helps to answer questions related to the episode of globalization and capital mobility and its current status in Sub-Saharan African countries. The time period 1988-2003 is interesting because it covers a period of openness

intensification and a period in which most Sub-Saharan African countries dramatically changed their policy and open their economies as a result of globalization.

1.3. Objectives of the Study

This study has the following objectives

- To gauge the degree of capital mobility in Sub-Saharan African countries for a sample period of 1988-2003.
- To determine whether financial market liberalization has led to increased capital mobility in the sense of Feldstein and Horioka (1980).
- To assess the level and driving forces of capital mobility in the Sub-Saharan African region.
- To review some recent empirical evidence on the extent of capital mobility.
- To suggest alternative policies and programmes for economic recovery in Africa.

1.4. Hypothesis of the Study

Given the objectives stated above, this study hypothesize that

- High correlation of savings and investment rates does not necessarily signal limited international financial transactions,

- Low estimated correlation between the rates of domestic savings and investment would mean that the net capital inflow is an important determinant of domestic investment.

- With perfect world capital mobility, there should be no relationship between domestic saving and domestic investment.

- The higher the capital mobility, the lower the domestic savings and investment.

- The higher the country's integration in the world capital market is, the larger are capital mobility.

1.5. Significance of the Study

In the light of the establishment of the African Union (AU) and the launch of the New Partnership of Africa's Development (NEPAD), this paper is expected to have benefit to look at how empirical findings would influence the objectives and strategic policy framework of these organizations. It will also help ensure that the African continent is prepared to deal with the challenges of the 21st century and to achieve the ultimate goal of African unity.

It also adds value to the already existing stock of knowledge and will supplement the existing empirical literature on capital mobility in Sub-Saharan African countries.

Moreover, the paper gives policy recommendation from a macroeconomic policy perspective, that the degree of international capital mobility in the developing world require special scrutiny.

With Sub-Saharan African countries investment and saving low – in historical context and compared to other countries – questions on investment and saving continue to arouse the interest of policy makers and researchers. However, knowledge about the underlying patterns of investment and saving is limited.

1.6. Scope and Limitation of the Study

Scarcity of relevant data, time, and budget has played a limiting role on the scope and content of the study. The study focuses only on 25 Sub-Saharan African countries out of 49 of them. This is with the assumption that addressing the problem well with data on these selected Sub-Saharan African countries will also help solving the problems of other non-Sub-Saharan African countries to a larger extent, though country specific factors could explain well the incidence of capital mobility, believing that most of the determinants are similar. Moreover, this study pays much attention to the determinants of capital mobility and its impact on the domestic economy of the Sub-Saharan African countries between a period of 1988 and 2003.

1.7. Organization of the Paper

This study is organized as follows: chapter two reviews the existing theoretical and empirical literature on capital mobility; chapter three presents the specific theoretical and empirical models and the different variables incorporated in the models; chapter four of the paper is concerned with analysis of the collected data, reporting the estimation results, and extensive discussion and interpretation of the results and finally, chapter five concludes the study by drawing policy implications.

CHAPTER TWO

REVIEW OF LITERATURE

2.1. Introduction

Capital flows are fundamental elements in economic performance. Such inflows are essential to finance investment, and economic policy is sensitive to the mobility of capital given the globalization of capital markets. Economic policy and performance influences inflows, and these inflows in turn have implications for macroeconomic policy. In the past three decades, many developing countries have liberalized their financial markets and, in addition, opened up their capital accounts. An expected consequence thereof is that these countries' access to international financial markets should improve. Potentially, there are many gains from increased financial integration. For instance, international capital mobility is crucial to global resource allocation, since it helps to smooth consumption and reduce risk. Furthermore, it allows for investment, and hence growth, beyond the premises of domestic saving. Theoretically at least, unrestricted capital flows facilitate specialization in the product of financial services, and so benefit the international economy. Competition from abroad is introduced in the financial industry and innovation is stimulated, all this creates dynamic efficiency.

Under certain circumstances that the global financial market is able to properly price the risks and returns inherent in financial claims, global saving can be

allocated to the most productive investments. Thus, potentially there are important welfare gains to be made from external financial liberalization. In the literature, two main methods are used to gauge the degree of international capital mobility. The first is studying the rates of return on capital across countries, a common approach when interest is in analyzing financial capital flows. Second, by studying the correlation between domestic saving and investment rates. Since the focus is on long-run real capital flows, this paper concentrate on the second approach.

2.2. Definition and Concepts of Globalization and Capital Mobility

These days globalization across various economies is a universal phenomenon to reckon with. Guillermo Calvo's (1993) framework of his prolific research was, indeed, the constraints on economic policy imposed by the integrated, and fluctuating, world capital market. Maurice Obstfeld and Alan M.Taylor (2003) examine the historical development of globalization (in particular, international capital mobility) by political-economy forces. After World War I, "newly or better-enfranchised groups such as the working classes" contributed to severely impede capital mobility. The peace and prosperity that emerged after World War II, and that intensified after the end of the cold war, unleashed political forces for free capital mobility.

It does not help to say that globalization can mean many things to many people but a minimum definition would be probably include a diminishing role for national borders and the gradual fusing of separate national markets into a

single global market place. The term globalization was probably first coined in the 1980s, but the idea has been around for a long time. Indeed, by some measures the world was more globalized a century ago than that it is now: certainly_people were far likelier to emigrate to find work. After an anti-trade backlash in the 1920s and 1930s, globalization has been accelerating during the past three decades. Innovations in communications and transport that let people and capital travel at great speed.

It is also useful to begin by clarifying the meaning of the term capital mobility. According to Dooley et al (1987), by capital mobility means that the productive activity can be shifted at low cost across countries. It is important to note that capital need not actually move, the possibility that it can is sufficient. This means that it can be difficult to find evidence for capital mobility. One indirect way is to compare rates of return across countries, the idea being that corporate mobility will equalize these. However, rates of return may differ because of many factors which it can be difficult to control for, e.g. country specific risks or a home bias to investment. While there is some evidence in the other direction[1] on balance it seems that the mobility of capital must have increased, due to the abolition of capital controls in most countries, the increasing member of free trade agreements[2] and the foundation of World Trade Organization.

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[1] See Inter alia Feldsteing and Horioka (1980), Dooley et al (1987) and Bayoumi (1990).

[2] Free Trade Agreements only have an Indirect Effect on Mobility of Capital, by Making it Possible to Produce Abroad and Continue Saving in the Home Market. Note that the Capital flow between Countries could also Decrease, because it will be less often Necessary to Locate Abroad to just avoid Tariffs. This does not however Constitute a Reduction in Capital Mobility as the term is most often by Economists and in this paper, because the cost of Moving Capital has not Increased.

If capital were mobile in this sense, there would be no reason to predict that countries with relatively high saving ratios over a given period would also have relatively high investment ratios, since savings would be redistributed to countries that offered relatively high rates of return on physical capital. The saving and investment ratios are highly correlated, however, is also consistent with several plausible alternatives to the view that capital is immobile.

Based on the above information, the broadest definition of capital mobility is Dooley et al (1987): International capital mobility is defined as the condition under which expected differential yields on physical capital in different countries are eliminated by net saving flows as conventionally measured by current account imbalances. Dooley (1987) conjectured that incomplete arbitrage within national financial markets might account for the fact that non-financial developments in some countries appear to be insulated from international capital markets even though domestic markets for a narrow class of financial assets are tied to similar foreign markets through interest arbitrage.

Capital mobility means that the tendency of investors to equalize expected rates of return on a subject of liquid, short-term, default free, assets denominated in different currencies or issued by residents of different countries, then there is little doubt that capital is mobile among the major industrial countries. This definition of capital mobility, however is of limited value. It is analogous to measuring the degree of integration of international goods markets by noting that prices measured in common currency are equalized for a subset of goods.

There are many agricultural and mineral commodities for which this condition holds quite strictly. It is clear that this condition tells us nothing about the tendency of prices of goods in general to be equalized across countries. In fact, this more interesting purchasing-power-parity measure of "goods mobility" has failed to hold in recent years. The key to this more general condition is that within countries the relative prices of goods change by substantial amounts and with no apparent tendency to return to their original levels.

2.3. The Feldstein-Horioka Paradox

In a world of perfectly integrated capital markets we expect to observe a weak to non-existent correlation between levels of (changes in) domestic savings and levels of (changes in) domestic investment for any country at any point in time. This is because, in the presence of perfectly fluid international capital markets, competition in assets will instantaneously equalize the international rates of return, in essence establishing the financial market analog of the postulated "Law of One Price" for international goods markets. For instance, if a small, (financially) open country experiences an exogenous domestic shock to its savings rate - for instance through an unexpected change in taxes on unearned income - the additional funds induced by the shock will flow abroad in search of the highest return rather than bidding down the domestic return to capital and leaving the world real interest rate unchanged (or, if a larger country experiences the shock, slightly depressed.)

From the mid-1960s to the early 1980s, this "perfect capital mobility" assumption underlay almost all economic models of floating exchange rate regimes among advanced economies. Results of empirical tests of asset arbitrage across OECD countries on financial assets such as equities and government bonds generally confirmed the "perfect capital mobility" assumption, particularly in the post Breton-Woods environment. Feldstein and Horioka use the perfect capital mobility assumption to form the null hypothesis of their 1980 paper: "With perfect world capital mobility, there should be no relationship between domestic saving and domestic investment: saving in each country responds to worldwide opportunities for investment, while investment in that country is financed by the worldwide pool of capital." In fact, in their seminal empirical study of the relationship between domestic savings and investment rates, Feldstein and Horioka forcefully reject this null hypothesis of perfect capital mobility. Using OECD data from the 1960s and 1970s they estimate an almost direct (one-for-one) correlation between proportional domestic savings and investment levels in a cross-section, an empirical finding later replicated by other authors in both cross-sectional using data from a variety of countries and time periods (up to about 1990), in both cross-section and times series frameworks, and for both levels and changes in rates of savings and investment across time and countries. In their paper Feldstein and Baccheta (1991) defend and reaffirmed their "paradox" and its implications for the reality of perfect capital mobility, with attention to the major empirical and theoretical challenges to their model. In fact, during 1990s economists begun to

find evidence that the cross-national savings-investment relationship may be growing weaker in the face of increasingly integrated and more technological advanced global goods capital markets, free trade and stable currency baskets. The counterintuitive and surprisingly robust sensitivity of domestic investment to domestic savings in a world of supposedly perfect capital mobility became known as the "Feldstein-Horioka (FH) Paradox".

2.3.1. The Feldstein-Horioka Approach and Alternative Interpretations

Frankel (1995) outlines for principal means of measuring capital mobility:

1) Using the Feldstein-Horioka definition,

2) Closed (or covered) interest parity: $i=i^*+fd$ where fd is the forward discount on domestic currency. Closed interest parity is largely a measure of the smoothness of the capital market measured by the availability of currency forwards which in turn eliminate currency risk and the wedge it could drive between domestic and foreign interest rates.

3) Open (or uncovered) interest parity: $i=i^*+\Delta s^e$ where s^e is the expected depreciation of the home currency over the period. Open interest parity implies that political risk differentials are relatively small so that investors feel safe holding foreign assets in foreign banks and risk wedges are minimized;

4) Real interest rates: $r = i + \pi^e = r^* = i^* + \pi^{*e}$ where π is a measure of inflation. Rearranging terms show that real interest parity requires that differences in nominal interest rate equal differences in expected inflation rates, which is the condition for ex-ante purchasing power parity to hold.

The first measure corresponds to long-run real capital flows, while the last three relate to financial capital flows.

While Feldstein and his various co-authors emphasis (3) as a means by which capital market imperfections can occur (the risk aversion wedge), Frankel accepts the basic findings of the literature that both (2) and (3) hold in general. But (4) will in general not hold due to imperfections in goods markets that tend to prevent purchasing power parity from holding over the short or long-run this being one of the other paradoxes of international macroeconomics. Unlike nominal interest rates, real interest rates are denominated in terms of goods produced in the home and foreign country respectively. In the absence of expected PPP, arbitrage will not likely close the gap between rates. Thus, according to Frankel, if the real returns on a country's equities were equal to the real return on its bonds, each evaluated in local good prices, then the real return on international equities would be internationally equated as well. But given the failure of real interest parity, neither foreign direct investment nor any other known force will equalize real returns on capital. Therefore, even in perfectly fluid capital markets - in the sense of low transactions costs and low risks associated with holding foreign currencies-rigidities in real capital flows

will persist and tend to keep physical investment in the home country while nominal investments flow abroad.

Feldstein and Horioka (1980) argues that increased financial integration should decrease the correlation between domestic investment and saving rate. The investment rate for country i can be written as follows:

$$\left(\frac{I}{Y}\right)_i = \alpha_i - \beta r_i + \varepsilon_i \quad \text{.....(2.1)}$$

where I is the level of capital formation, Y the national output, r the domestic real interest rate, α the intercept, and ε represents all other factors that determine investment. Since it is assumed that the national saving rate is a function of the real interest rate, Feldstein and Horioka estimated the following equation:

$$\left(\frac{I}{Y}\right)_i = \alpha_i + \delta\left(\frac{S}{Y}\right)_i + \nu_i \quad \text{.....(2.2)}$$

where S is measured as gross national product minus private and government consumption, α_i the intercept, and v the error term. With perfect capital mobility, an increase in the saving rate in country i would cause an increase in the investment rate in all countries. Assuming an infinitesimally small country relative to the world economy, the slope coefficient δ, given perfect capital mobility, would be zero. For a relatively large country, the value of the slope coefficient would correspond in magnitude to its share of total world capital. FH tested a sample of 16 OECD countries, performing regressions based on the average ratios obtained from 1960 to 1975, and separate regressions for the

average ratios in each of three five-year sub-periods. The parameter of interest is δ. An estimated δ insignificantly different from zero implies that levels of domestic investment do not respond to levels of national savings, and therefore, under the FH hypothesis, that capital markets are perfectly fluid. An estimated δ significantly different from zero implies that changes in domestic savings do influence domestic investment and therefore that there is some stickiness in capital mobility. A δ insignificantly different from one represents the extreme case of a (financially) closed economy in which domestic savings, at least in the long run, are directly channeled into domestic investment. Wherever δ is different from zero, there is a failure of arbitrage in achieving a single international long-run real interest: capital market rigidity.

In their basic regression analysis, FH estimate a δ for the entire fifteen-years period of 0.89, which they find to be insignificantly different from one at conventional confidence levels. When they break the estimations down into five-year sub-periods, they find essentially the same δ for each of the five-year periods, all insignificantly different from each other and from one. The authors run additional regressions controlling for economic growth; for varying country size; and for savings and investment disaggregated by source (corporate, private, and government). In the latter regression they find that corporate investment is most responsive *(δ=1.85)* to corporate saving. To test for endogeneity of domestic savings, including possible reverse causation, they essentially replicate their δ in a 2SLS model in which domestic savings is

instrumented by measures of the ages composition of the population and the presence of pay-as-you-go social security. Finally they run an additional regression to test for the response of investment to changes in the saving rate between the 60s and early 1970s, again, FH find further support for their theory that domestic investment adjusts over the medium-run to changes in domestic savings rates *(δ=0.724)*. They conclude that, contrary to conventional wisdom in the literature based on observation of short-run arbitrage in international asset prices, international markets for long-run capital are highly, even most, imperfect.

The Feldstein-Horioka finding that, additions to the domestic supply of capital do not appear to move abroad in search of the maximal return sparked enormous controversy in the field of international macroeconomics, particularly as their economic results seemed to violate not only conventional wisdom about capital market mobility, but also observed arbitrage relationships in international assets. As a result, in the years following FH's original publication, many economists set out to contradict, replicate and otherwise account for their results. Many of the criticisms and justifications drew or expanded on basic ideas and empirical techniques presented in the original paper.

2.3.2. Refinements to the Feldstein–Horioka Approach

Several authors contended in the years following FH's initial publication that the empirical results derived from the simplest FH model do not actually prove

that capital markets are imperfect because the regression (2.2) does not adequately account for endogeneity: that is, for unobserved variables that might cause proportional savings and investment to move in the same direction even if they actually share no causal link. Dooley et al (1987) put it as follows: Any economic variable, in addition to the cost of capital, that influences the investment rate, will probably be correlated with the national saving rate and therefore, regressions of proportional savings on proportional investment may simple reflect spurious correlation. In order for savings and investment rates to be perfectly uncorrelated that is, in order for (2.2) to yield a $\delta = 0$, three conditions must hold:

I. Domestic investment must depend only on the real rate of return to investment (the real interest rate r) and on purely random factors ε that are uncorrelated with national saving;

II. The real rate of return is determined on the world market and is exogenous to changes in the saving or investment behavior of any given country (that is, domestic investors are price takers in capital);

III. The domestic expected real rate of return equals the international expected real rate of return. $(r = r^*)$

Condition (III) is equivalent to capital flows being completely free to flow across borders and thereby to equate the marginal return to capital across countries, i.e. it is the necessary condition and empirical proof of perfect capital mobility.

Using a slightly different version of (2.2) in which domestic investment is defined as dependent on interest rates rather than savings, and the capital account identity

$$\frac{I}{Y} = hr + \varepsilon_i \qquad KA = k(r - r^*) \quad \text{.....(2.3)}$$

then if condition (III) holds, the coefficient k is infinite (or at least very high). Following Dooley et al (1987), the covariance of investment and national saving can then be decomposed into three parts:

$$\text{cov}\left(\frac{I}{Y}, \frac{S}{Y}\right) = \text{cov}\left(\varepsilon, \frac{S}{Y}\right) - h\,\text{cov}\left(r^*, \frac{S}{Y}\right) - h\,\text{cov}\left(r - r^*, \frac{S}{Y}\right) \quad \text{.....(2.4)}$$

In order for (2.2), or a variant of it to accurately test condition (III) as FH claim, conditions (I) and (II) must also hold, so that the first and second terms of the right hand side of (2.4) are zero. In practice, conditions (I) and (II) are highly unlikely to hold. In the wake of FH's 1980 article, several authors introduced theoretical objections as to why these conditions might in fact be violated, and thereby why FH's findings might not be evidence of imperfect international capital markets. The three main objections to the FH result, based on violations to the exogeneity of savings implied by (I) and (II), are discussed below.

The first objection, advanced by Obstfeld (1986) held that the observed saving-investment correlations might simply be a spurious result of overall economic growth. He formalizes this idea with a life-cycle model of a standard representative agent who lives amid a continuum of his peers for two periods in

a small open economy. An exogenous increase in the population growth rate of this economy will cause both proportional savings and proportional investment to grow for unrelated reasons: savings because younger (saving) generations will always form a greater proportion of the population than older (dissaving) generations when population growth is higher; investment because a rapidly growing labor force will require increasingly more capital, even if this capital is funded by borrowing on the international financial market. Using a calibrated version of his theoretical model based on OECD data, Obstfeld is able to replicate the FH result without assuming anything about capital mobility. However, Feldstein and Bacchetta argue in their 1991 rejoinder that Obstfeld's hypothesis is not convincing because the inclusion of variables controlling for population and economic growth in the original and 2SLS variations of the FH estimations do not significantly effect their estimated δ's.

Summers (1985, 1988) advanced a second challenge to the exogeneity and exclusivity of domestic savings as a determinant of domestic investment: governments may respond with policy prescriptions to changes in the national rates of saving and investment, thereby violating condition (I). In particular, summers postulates that governments may tailor the size of the budget deficit to offset differences between private saving and investment, to keep them aligned. For instance, the government that is happy with the current rate of capital growth in a closed economy or who does not want to see additional capital to flow abroad in an open economy may choose to offset an exogenous positive shock to optimal private saving by decreasing public saving (running a

deficit) so as to leave net national saving unchanged.[3]

To test this endogenous – policy hypothesis, Summers regresses measures of the average gross-investment-to-gross-savings ratio on the deficit-GDP ratio for a cross-section of OECD countries averaged over the period 1973 to 1980 and estimates a coefficient of 0.72. However, Feldstein and Bacchetta (1991) argue that there is no reason to believe that Summers' regressions actually indicate a policy response – particularly over the long-run under examination – rather than simply traditional crowding-out of investment by (exogenously determined) budget deficits. They run their own version of Summers' hypothesis by estimating:

$$\left(\frac{I}{Y}\right)_i = c_o + c_1\left(\frac{DEF}{Y}\right)_i + c_2\frac{PS}{Y} + \varepsilon \qquad (2.5)$$

where the original FH hypothesis (constant with $\delta = 1$) would hold that c_1 (coefficient on the budget deficit) and c_2 (coefficient on private savings) are of equal magnitude and opposite sign: that is, perfect substitutes for each other. For this sample of 13 OECD countries, they cannot reject this hypothesis that private and public savings influence investments identically. This finding does not in itself does not empirically reject Summers' or related endogenous policy arguments because if governments are using deficit policy to influence rates investment, the policy would in fact be most effective if private and public

[3] An Alternative Theory Advanced by Sachs (1983) holds that, rather than Running Deficits, the Government of small open Economy might respond to an Exogenous Positive Savings Shock by Engaging in a Complementary Policy to Encourage Domestic Investment, thereby Soaking up the Increased funds before they go Abroad in Search of Higher Return. Of course, this would also Violate Condition (I).

savings were in fact perfect substitutes; the question of determining causation is difficult to address.

Another explanation provided by Obstfeld (1986) is concerned with the inter-temporal budget constraint of an open economy, which relates the difference between saving and investment, i.e. the current account, to changes in net-foreign assets. If, between start and end of sample period, the economy does not diverge much from its steady-state ratio of net-foreign assets to income, and if nominal income growth remains moderate, the difference between saving and investment can, on the average, be small even under perfect capital mobility. Thus, if the economy is close to a constant ratio of foreign assets to income, it is possible to show that saving and investments cannot diverge much in the long run. According to Obstfeld, this can explain the displayed low cross section saving-investment correlations in developing countries, before the debt crisis, compared to the industrial ones. Ultimately, the cross-section saving investment correlation within a group of countries with open capital markets depends on the extent of each country's long-term inter-temporal trade gains with other countries. However, Obstfeld's reasoning appears more valid in a mature economy, where inter-temporal trade gains are only transitory, than in developing economies where unexplored investment opportunities imply that external debt levels are well below their steady-state levels.

Baxter and Crucini (1993) construct a quantitatively restricted model and find that a high (time-series) correlation between saving and investment is

consistent with high capital mobility. Furthermore, this correlation increases with country size. Harberger (1980) argues that as countries become larger, they become more diversified. Shocks to saving and investment thus tend to cancel out and, there is therefore in the aggregate proportionately less need for that country to borrow or lend offshore.

Wong (1990) notes that while in the simple traded good model there is no a priori reason to believe that saving and investment are correlated under capital mobility, introduction of a non-traded sector reverses this conclusion. According to Wong, if both traded and non-traded goods are consumed at home, an increase in the saving rate leads to increased wealth and consumption in the future. Consumption of non-tradables can increase only if their production increases as well. This necessitates investment. Thus, correlation between saving and investment is possible even under perfect capital mobility.

Schmidt-Hebbel et al (1996) mention the close link between corporate investment and retained earnings as an explanation for the high correlation between saving and investment. The reason for retaining capital in the home country is because capital owners prefer to avoid currency and political risks. The authors argue that this explanation is highly relevant for developing countries.[4]

[4] For instance, Studies by Isaksson and Wihlborg (1994, 1995) on Kenyan Enterprises show that Corporate Investments are mainly Financed by Retained Earnings.

2.4. A Review of Previous Empirical Research[5]

Studies based on the Feldstein-Horioka approach use cross-section analysis, where each observation consists of a country's average investment and saving rates over a given period, and time-series analysis, where each observation consists of a country's investment and saving rates per period. Some very recent articles also employ panel-data techniques, which are a combination of cross-section and time-series analysis. The idea of the cross-section approach is to eliminate the influence of short-run fluctuations around long-run means. This is achieved by averaging each country's investment and saving rates over a sufficiently long time period. Short-run relations are captured by time-series estimation.[6] Although both strategies are useful in assessing capital mobility, it is not necessarily the case that slope coefficients from the two methods contain the same information. Assume, for instance, that in a sample of N countries, mean saving and investment rates are strongly correlated on a cross-section basis, while for each individual country deviations of saving rates from their time-series mean are poorly correlated to those for investment rates. If cross section observations are country averages over T periods, then OLS estimates of the slope coefficient will be high if N and T are sufficiently large. However, given the above, the time-series slope coefficient could be close to zero for each country (Obstfeld 1995).

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[5] Almost all the studies Referred to Correct for Simultaneity Bias by using IV-estimation Techniques. Commonly used Instruments are Demographic Variables (e.g. the ratio of the Elderly in total Population and the Dependency ratio), Military Expenditure as a share of GNP, and Government Consumption as a share of GNP.

[6] Short-run Variation in Usually Captured when the Regression is run in first Differences.

The following review is confined to papers using cross-section and panel-data analysis.[7] As will be seen, in the papers reviewed the slope coefficient has been close to unity. Moreover, only occasionally has the slope parameter been falling over time despite financial liberalization. It thus appears that non-trivial investment-saving correlations exist.

In a study of 16 OECD countries Feldstein and Horioka (1980) found a slope coefficient of 0.88 for the period 1960-1974. Correcting for the endogeneity problem did not change the results.[8] This was interpreted to mean that capital was internationally immobile. But why should countries with relatively open capital accounts and where capital movements are not controlled exhibit such a high degree of capital immobility? It is this unexpected and puzzling result that has led to extensive research.

Feldstein (1983) estimated Equation (2.2) for 17 OECD countries for the period 1974 1979. The slope coefficient was 0.86, close to that arrived at by Feldstein and Horioka (1980). Using data from the 1980s, Feldstein and Bacchetta (1991) found a lower coefficient, but still indicating low capital mobility. However, Obstfeld (1995) estimated a lower coefficient than Feldstein and Horioka (1980) for 22 OECD countries for sub-periods from 1974-1990. He also found that the coefficient drops over time (although for the last sub-period the coefficient increased somewhat), indicating that capital mobility had increased with test of the degree of capital mobility is to estimate Equation (2.2) under a presumably

[7] Examples of Time-series Analysis are Bayoumi (1990), Argimon and Roldan (1994), Montiel (1994), Frankel (1995), Obstfeld (1995) and Mamingi (1997).
[8] It thus seems that Endogeneity is not the Explanation for the Exhibited high Correlations.

high capital mobility period such as that of the Gold Standard. Using this strategy, for a slightly different dataset, Obstfeld (1995) again was able to refute Feldstein and Horioka's results of low capital mobility.

Bu using total saving and investment for 10 OECD countries for 1965-1986, Bayoumi (1990) obtained similar results as Feldstein and Horioka (1980). The story changed when private saving and fixed investment data were used instead. The slope coefficient dropped over time, which is consistent with the view that financial deregulation has improved capital mobility. Bayoumi (1990) also adjusts the saving measure for Ricardian equivalence and again finds a smaller coefficient. Thus, it would appear from Bayoumi's results that the government's fiscal behavior has been a major factor in explaining post-war correlations between investment and saving rates.

Wong (1990) draws samples from 45 developing countries and finds that the choice of sample has an important effect on the saving-investment correlation for the sample period 1975-1981. Especially, excluding five countries in the Middle East increases the regression coefficient from a statistically insignificant parameter of 0.08 to a significant parameter of 0.61. Thereafter, Wong shows that as countries' import ratios decrease (meant to represent the size of the non-traded sector) the correlation between saving and investment increases. The author, however, acknowledges that including the import ratio in an investment-saving regression can be given several interpretations and he therefore includes two different capital-control proxies in the regression. With

those measures Wong is able to show that countries with extensive capital controls also have a higher saving-investment correlation.

Dooley et al. (1987), in their study a combination of 14 industrialized and 50 developing countries, they split the dataset into two distinct periods, 1960-1973 and 1974-1984. Their OLS estimations show that industrialized countries have a larger slope coefficient than developing ones. Additionally, it appears that over time the coefficient increases instead of the reverse. When the IV-technique is used to correct for the endogeneity problem, the slope coefficient for developing countries becomes insignificant, while it is negative for the 1960-1973 period. The opposite result is obtained for industrialized countries, with the coefficient increasing. They concluded that a close association between domestic saving and domestic investment is a robust empirical regularity and that their finding casts doubt on the view that national markets for physical capital are highly integrated. For developing countries, they concluded that this regularity is not apparent and that this may be due to the dependency on aid to finance their current-account imbalances.[9]

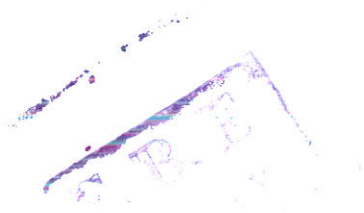
An interesting approach is carried out by Bayoumi and Rose (1993), who use regional saving and investment in the United Kingdom to estimate the slope coefficient. Since both financial and goods markets are well integrated inside a country, they found a relatively low slope coefficient and support for the Feldstein-Horioka hypothesis in a study of private saving and investment in

[9] Hanson (1992) and Montiel (1994) more Strongly argue that Foreign Aid might Explain the low Correlations for Developing Countries.

Japan. When using total saving and investment, however, the Feldstein-Horioka hypothesis was not supported.

Vamvakidis and Wacziarg (1998), to our knowledge, are the first to investigate saving-investment correlations using panel-data methods. They divide their sample into low-income and middle-income countries, and OECD-countries. The authors first run the usual cross-sectional OLS and IV-regressions using decade averages. Thereafter, they run fixed-effects model using both yearly data and decade averages. For the cross-sectional estimations they find that the null of zero slope coefficient can be rejected for developed as well as developing countries. However, contrary to expectations the OLS slope coefficient is much larger for developed countries than for their developing counterparts. Furthermore, the IV regression tend to decrease the slope parameter and not increase it as one might expect. Turning to their panel estimations, again OECD countries display larger slope parameters than do developing countries. For the 'All Developing Countries' category (83 countries) the panel-data slope parameters range from 0.14 to approximately 0.39, while the non-panel estimates are even low. The slope parameter seems to be increasing as income increases. The authors explain their somewhat odd results by foreign aid and debt repayments, and that similar countries have relatively little capital flowing among them.

Summarizing the results from previous studies, it appears that endogeneity cannot explain the Feldstein-Horioka puzzle. The use of Equation (2.2) seems to



give sensible results with respect to intra-national capital movements, but somewhat odd results with respect to international ones. For instance, some results indicate that capital mobility is greater in developing countries than among industrialized ones. Many different explanations have been used to explain the persistence of the Feldstein-Horioka result, but inclusion of other explanatory variables seldom produces convincing alternatives to the Feldstein-Horioka interpretation. However, the results tent to show the expected large slope parameter estimates for developing countries that other studies seem to have had problem to produce. Inclusion of foreign aid in the saving-investment regression appears to explain some of this increase in parameter size. Furthermore, they are also able to show that capital mobility indeed has increased over time.

Coakley, J. et al (1996) in their paper they suggest an alternative explanation of the high cross-section association between shares of saving and investment in GDP which Feldstein and Horioka (1980) interpret as evidence of low capital mobility. In OECD countries, their results shows that a solvency constraint implies that the current balance is stationary and thus that saving and investment co-integration with a unit coefficient irrespective of the degree of capital mobility. It is this long-run relation that FH cross-section regression captures. Econometric results for 23 OECD countries over the 1960-92 period are consistent with this explanation. Casella, A. and Eichengeen, B. (1996) studies the effects of foreign aid on economic stabilization.

Taylor, A.M. (1996) in his study argues that literature by investigating long-and short-run criteria for capital mobility using time-series and cross-section analysis of saving-investment correlation for twelve countries since 1850. The results present a nuance picture of capital market evolution. The sample shows considerable cross-country heterogeneity. Broadly speaking, the inter-war period, and especially the great depression, emerge as an era of diminishing capital mobility and only recently can we observe a tentative return to the degree of capital mobility witnessed during the late nineteenth century. Vamvakidis and Wacziarg (1998) and Isaksson (2001) provision is made in their model to show the dependency of the less developed countries on international finance and did and how a more open economy contributes towards improving the level of capital movement in these countries. They also assess the change in the degree of capital mobility over the time period in an effort to see whether institutional and political changes have been successful.

By using the panel data Corbin, A. (2001), his study leads to new interpretation of the Feldstein-Horioka paradox. A high estimated saving-investment coefficient may be due less to low capital mobility than to the existence of specific individual effect. His study has underlined the importance of controlling for the heterogeneity of countries in cross-section analysis of saving-investment correlation for a group of countries using panel data. Watson (2001) debated that, the scope of feasible policy-making in an era of globalization continues to be set within the context of an assumption that national capital markets are now perfectly integrated at the international level. However, the

empirical evidence on international capital mobility contradicts such an assumption. He attempt to share this puzzle by arguing that ideas about global capital market integration have an independent causal impact on political outcome which extends beyond that which can be attributed to the extent of their actual integration.

Agbetsiafa, D. (2002) extended the debate to six emerging economies in Africa using co-integration tests proposed by Johansen and Inselins and causality test based on an error correction model. The results indicate that saving and investment are integrated of order one. Furthermore, co-integration test show that the two series share a long-run equilibrium association in the six countries, and therefore lend support to the Feldstein-Horioka conclusion that long-term capital is not mobile internationally. According to Loots, E. (2005), in the 1960s and early 1970s the future of Africa looked bright and promising. Economic growth and development on the continent was considerably higher than in other developing regions. However, during the 1970s political instability increased and economic development started to deteriorate, both contributing to the marginalization of the continent. The continued marginalization constitutes a serious threat to the participation of Africa in the global economy. NEPAD calls for a reversal of this process through a new partnership between Africa and the international community.

2.4.1. Empirical Evidence on the Paradox Since 1975

Another question arising from the FH paradox is whether it will continue to hold as the global economy continues to liberalize and integrate. In their 1991 paper, Feldstein and Bacchetta updated the empirical results from the original 1980 paper to see whether the correlation between national saving and investment for OECD countries persisted through the 80s, in particular in response to European integration, the repeal of market barriers to free trade in Europe and Japan and unprecedented large capital flows to the United States. Their most striking finding, based on data up to 1986, is how rapidly the estimated δ from Equation (2.2) falls between the 1960s and 1980s (from 0.742 to 0.356) for the sample of EEC countries, in contrast to a much slower drop over time for the non-European countries, though large standard errors and small sample size do not allow the authors to draw statistically significant conclusions. The results suggest that the FH paradox may at least in part reflect a failure of capital markets (not only through the failure of PPP) as initially postulated, but that such imperfections dissipate as institutional links, like those between the EEC/EU countries, improve.

Tesar, Linda (1991) addressed the relationship between short run and long-run rigidities providing a partial response to the postulated difference between short run and long-run rigidities. Most authors have focused on cross-sections of OECD countries where relevant rates are averaged across many years. Tesar repeats the FH analysis on a group of 23 OECD countries for the period up to 1986, where ratios are averaged over five, three and one-year periods. She finds

essentially the same δ-significantly different from zero, insignificantly different from one and declining slightly over the period from 1960-for both the short and long-run averages, thereby suggesting that capital rigidities do not occur because of long-run adjustment, but in fact that investment responds quickly to changes in domestic savings (a finding strengthened also in a time-series framework by the regression 2.6. Tesar also finds further strengthening of the FH result among OECD countries through a close examination of the usual international data used in FH regressions. In particular, Luxembourg is a strong outlier (high annual savings; low annual investment) whose inclusion in various cross-section regressions may unduly bias the δs obtained by some authors (though not FH who originally excluded Luxembourg from their sample) downward.

The original FH study and most of its replicas are cross-sectional analysis focusing on OECD and subsets of OECD countries. However, one strong robustness check of the puzzle is to estimate a version of it for a single country over time. Frankel (1985) uses a time-series approach to test the FH paradox for the United States over the period 1890 to 1985, instrumenting for national savings with measures of military expenditure and the age composition of the US during a given decade, and using decadal averages of savings and investment rates. His results support the FH paradox (apart from his separate theoretical analysis) in that his coefficients average 0.8, are significantly different from zero and are insignificantly different from one over the postwar period.

Obstfeld (1995) also runs a time series version of the simple FH model:

$$\frac{I}{Y} = \alpha + \beta \frac{S}{Y_t} + \varepsilon_t \quad \text{.....(2.6)}$$

$$\Delta \frac{I}{Y_t} = \alpha + \beta \Delta \frac{S}{Y_t} + \varepsilon_t \quad \text{.....(2.7)}$$

for "levels" (2.6) and "differences" (2.7) over time, for a variety of OECD countries over the period 1974 to 1990. For most countries, the results provide more confirmation of the FH paradox. However, anomalies such as the UK ($\beta_{level}=0.113$; $\beta_{diff}=1.002$) and Germany ($\beta_{level}=0.327$) suggest, in the author's words, that "annual time-series correlations contain little information about the relationship between savings and investment over long periods". The results also suggest, as Feldstein (1997) emphasizes, correlations between savings and investment will differ across countries, depending on how integrated a country is with its regional neighbors (for instance in the EEC/EU).

Another empirical question that arises from the FH puzzle is whether its findings are limited to the industrialized world. Dooley et al (1987) were the first to repeat the FH cross-section analysis for a sample including both industrialized and developing countries. Intuitively (and inline with Feldstein's results for the EEC vs. the non-Europe OECD), one would expect the industrialized countries to have much more integrated and fluid capital markets, hence lower correlation coefficients between domestic saving and investment. However, the authors find that the opposite result holds: the

estimated βs from 2SLS regressions of (2.6) and (2.7) are closer to zero both for the sample of developing countries than for the sample of OECD countries; and for the sample of countries who rely primarily on the IMF for credit than for the sample of country who borrow primarily on the international market.

Finally, Hiroshi Gungi (2003) provides a recent updated the original (simplest) FH Model (2.2) for the years 1970 to 2000, together and by decade to examine how the FH model has held up over time. First, using a sample of 20 OECD countries, he tests the FH relationship by decade from the 1970s to the 1990s. His finding for the earlier two decades is quite close to the original FH result (δ=*0.77* before 1980; δ=*0.68* before 1990). Since 1990, however, the estimated coefficient falls to δ=*0.39* (though it remains significantly different from zero) while the R^2 for the regression falls over 0.80 to 0.41 for the later period. These results - which further a trend detected in Obstfeld (1995), Feldstein and Bacchetta (1991) and Tesar (1991) for the years leading up to 1990 – suggest that, over the 90s, the FH result has been growing weaker within the OECD, perhaps in response to increasingly integrated financial markets, themselves products of global changes such as the tighter integration of Europe and the continued lowering of both trade and capital market barriers in Europe, North America and Japan over the past 20 years.

CHAPTER THREE

METHODOLOGY

3.1. Data Type, Sources and General Methodology

The dataset in this paper covers 25 Sub-Saharan African countries. The relevant data for the study has been collected from various issues of the World Bank African Data Base and World Bank Development Indicators. The key variables in the estimation are gross savings and investment. There are two main reasons for using gross savings, first, it is the former that moves between countries and second, the accounting definition of depreciation differs across countries and may be improperly measured in the presence of high inflation. Savings are measured as gross national product minus government and private consumption.

From table (3.1) presents some descriptive statistics for the saving and investment variables for all sub-Saharan African countries in the sample countries in the sub-Saharan African region often exhibit higher investment than saving rates. The reason is mainly made up of net aid inflows sub-Saharan African countries also have negative minimum saving rates likely explanations are that the continent is vulnerable to external shocks such as draught, withdrawal of foreign aid, and sudden falls in export prices. When the shocks hit the economies, often already burden of with grave problems, national income trends to fall severely. Examples of such shocks are the impact

of the Rwanda genocide of 1994, the famine in Ethiopia in 1972-1974 and 1984, the national bankruptcy in Sera lion in 1978, repeated aid suspensions to Togo that negatively affected numerous countries in Africa. To maintain consumption, investment, and import levels the countries have to borrow or rely on foreign aid. Thus, when the saving rate is calculated as a residual it could become negative.

Table-3.1: Descriptive Statistics: Mean Investment and Saving Rates Across Countries 1998 – 2003

N*	Investment				Saving				Time Period
	Mean	Std. dev.	Min.	Max.	Mean	Std. dev.	Min.	Max	
25	0.012982	0.024036	0.000112	0.162677	0.001420	0.018060	-0.172829	0.041096	1988-2003

** N= sample size (total number of countries considered)*

To access the impact of globalization and capital mobility in the Sub-Saharan African countries we employ a panel of 25 countries for the time period 1988-2003. When estimating relationships amongst variables it is customary to use variables in real terms, converted to a common denomination. The benefit of panel data estimation, and in particular the fixed effects techniques, is that it is able to acknowledge country-specific heterogeneity.

STATA 9 and EVIEWS 5 statistical software's are used in this study because of their superiority in stationary panel data estimation, techniques and panel unit root test respectively.

For a list of variable and country names used and included in the sample the reader is advised to refer the attachment included in the Annex.

3.2. Estimation Procedure

To assess the relation between saving and investment in Sub-Saharan African region, Feldstein-Horioka (1980) model of the form has been employed and enhance the model for the study, which is specified below.

$$\left(\frac{I}{Y}\right)_i = \alpha + \beta\left(\frac{S}{y}\right)_i + \varepsilon \quad \text{.....(3.1)}$$

and, since it is assumed that the national saving rate is a function of the real interest rate,

$$\left(\frac{I}{Y}\right)_i = \alpha_i - \beta r_i + \varepsilon_i \quad \text{.....(3.2)}$$

where I is the level of capital formation, Y the national output, r the domestic real interest rate, α the intercept, ε represents all other factors that determine investment.

$\left(\frac{I}{Y}\right)_i$ is the ratio of gross domestic investment to gross domestic product in country i and $\left(\frac{S}{Y}\right)_i$ is the corresponding ratio of gross domestic saving to gross domestic product in country 'i' and β is the retention coefficient.

To test for endogeneity of domestic savings, including possible reverse causation Feldestein-Horioka replicate their β in a 2SLS model in which

domestic savings is instrumented by measures of the age composition of the population and presence of pay-as-you-go social security.

More specifically the equation describing intercountry differences in saving rates is

$$\left(\frac{SP}{Y}\right)_i = \gamma_o + \gamma_1 G_i + \gamma_2 AGE_i + \gamma_3 DEP_i + \gamma_4 (B/E)_i + \gamma_5 LPAGED_i \quad \text{.....(3.3)}$$

where SP/Y is the private saving rate, G is the growth rate of total private income, AGE is the ratio of the number of retirees over the age of 65 to the population aged 25-65, DEP is the ratio of the number of younger dependents to the working age population, B/E is the benefit earnings replacement ratio, or the social security programme, and LPAGED is the labor force participation rate of older men.

The overall domestic saving ratio is related to private saving according to

$$\left(\frac{S}{Y}\right)_i = \left(\frac{Sp}{Y}\right)_i + \left(\frac{SG}{Y}\right)_i \quad \text{.....(3.4)}$$

where SG is government saving and SP is private saving.

Finally, there is the investment-saving relationship discussed aforementioned and repeated here for convenience:

$$\left(\frac{I}{Y}\right)_i = \alpha + \beta\left(\frac{S}{Y}\right)_i \quad \text{.....(3.5)}$$

Explicitly, components of saving and investment i.e. disintegration of total saving into three components: household saving, corporate saving and government saving are incorporated equation (3.1), it represent as,

$$\left(\frac{I}{Y}\right)_i = \alpha + B_H\left(\frac{SH}{Y}\right)_i + B_C\left(\frac{SC}{Y}\right)_i + B_G\left(\frac{SG}{Y}\right)_i \quad \text{.....(3.6)}$$

where SH is household saving, SC corporate saving, and SG government saving. This equation is also estimated with total investment replaced by private investment or corporate investment.

This disintegration is important because it makes possible to see whether domestic investment is equally responsive to all types of saving.

In our view the evidence that levels and changes in national saving and investment ratios move together stands up to the empirical issues.

The empirical research on international capital flows proposes two approaches to measuring capital mobility (Obstfeld, 1986; Frankel, 1993):

i. estimating saving-investment correlations, and

ii. comparing interest rate parities across countries. The former approach focuses on a regression of the domestic investment-to-output ratio on the domestic saving-to-output ratio, where a coefficient of 0 indicates perfect capital mobility (Feldstein and Horioka, 1980). The latter approach requires data on exchange rate expectations, which are not available for

our sample. Therefore, we base our measure of capital mobility on saving-investment correlations.

Hence, to assess the level of capital mobility in Sub-Saharan Africa we estimate the modified equation (3.1) to the following form:

$$\left(\frac{I}{Y}\right)_{it} = \alpha_{it} + \beta_1\left(\frac{S}{Y}\right)_{it} + \beta_2\left(\frac{CA}{Y}\right)_{it} + \beta_3\left(\frac{Aid}{Y}\right)_{it} + \beta_4 open_{it} + \beta_5\tau_{it} + \beta_6\delta_{it} + \varepsilon_{it} \quad \text{.....(3.7)}$$

where $\left(I/Y\right)_{it}$ is the ratio of gross domestic investment to gross domestic product in country$_i$ at time t, with $\left(S/Y\right)_{it}$, $\left(CA/Y\right)_{it}$, and $\left(Aid/Y\right)_{it}$ the corresponding gross domestic saving, the current account and financial aid to gross domestic product ratios. By including both the current account and the aid variable, we are not only capturing the effects of foreign aid on saving behavior but also make provision for foreign investment funds induced by the current account. Where previous studies have only included either the current account or the aid variable in the model in fear of multicollinearity, it was possible for us to avoid this problem, as the correlation between the two variables in the sample is very weak. This implies that by excluding either of the two variables, misspecification bias is actually introduced into the specification. Once again, the inclusion of the openness variable is important, as it could have a significant positive effect on the ability of capital mobility on this model specification further encompasses all previous studies in that it makes provision for two interactive dummy variables; τ and δ. The South African

interactive dummy (τ) is constructed by multiplying the saving rate of each country by a South African dummy variable that aims to acknowledge the fact that South Africa may have a different capital mobility and saving behavior than the rest of the Sub-Saharan African countries. In a Sub-Saharan African context, South Africa can be regarded as a developed country and therefore bias the saving rate coefficient of the rest of the region upwards if we do not specify for this difference. If significant, the actual savings rate coefficient for South Africa would be the sum of β_1 and β_5. The time interactive dummy (δ) is constructed by multiplying a time trend with the saving rate of each country. According to Isaksson (2001) this dummy variable will capture the change in the savings rate for the time period in order to evaluate the effectiveness of policy and institutional changes aimed at improving capital mobility.

Constant Coefficients Model

One type of panel model has constant coefficient, referring to both intercepts and slopes. In the event that there is neither significant country nor significant temporal effects, we could pool all of the data and run an ordinary least squares regression model. Although most of the time there are either country or temporal effects, there are occasions when neither of these is statistically significant. This model is sometimes called the pooled regression model. The pooled estimation model is the most restrictive of all the specifications and does not acknowledge any cross-section heterogeneity with the Sub-Saharan region, assuming a common intercept for the whole panel.

The Fixed Effects Model (Least Squares Dummy Variable Model)

Fixed effects model acknowledges cross-section heterogeneity and assumes a different intercept for each country included in the sample. Fixed effects model would have constant slopes but intercepts that differ according to the cross-sectional (group) unit - for example, the country. Although there are no significant temporal effects, there are significant differences among countries in this type of model. While the intercept is cross-section (group) specific and in this case differs from country to country, it may or may not differ over time. These models are called fixed effects models.

After we discuss types of fixed effects models, we proceed to show how to test for the presence of statistically significant group and/or time effects. Finally, we discuss the advantages and disadvantages of the fixed effects models before entertaining alternatives. Because *i-1* dummy variables are used to designate the particular country, this same model is sometimes called the Least Squares Dummy variable model. (Equation 3.8)

$$y_{it} = a_1 + a_2 group_1 + a_2 group_2 + ... + a_2 group_{24} + \beta_2 \left(\frac{S}{Y}\right)_{it} + \beta_3 \left(\frac{CA}{Y}\right)_{it}$$

$$+ \beta_4 \left(\frac{Aid}{Y}\right)_{it} + \beta_5 open_{it} + \beta_6 \tau_{it} + \beta_7 \delta_{it} + \varepsilon_{it} \quad \text{.....(3.8)}$$

Another type of fixed effects model could have constant slope but intercepts that differ according to time. In this case, the model would have no significant country differences but might have autocorrelation owing to time-lagged

temporal effects. The residuals of this kind of model may have autocorrelation in the process. In this case, the variables are homogenous across the countries. They could be similar in region or area of focus. For example, technological changes or national policies would lead to group specific characteristics that may effect temporal changes in the variables being analyzed. We could account for the time effect over the *t* years with *t-1* dummy variables on the right-hand side of the equation. In the following equation, the dummy variables are named according to the year they represent.

$$\left(\frac{I}{Y}\right)_{it} = a_1 + \lambda_2 year1988 + \lambda_3 year1989 + ... + \lambda_{15} year2002 + \beta_1\left(\frac{S}{Y}\right)_{it} + \beta_2\left(\frac{CA}{Y}\right)_{it}$$

$$+ \beta_3\left(\frac{Aid}{Y}\right)_{it} + \beta_4 open_{it} + \beta_5\tau_{it} + \beta_6\delta_{it} + \varepsilon_{it} \quad \text{.....(3.9)}$$

There is another fixed effects panel model where the slopes coefficients are constant, but the intercept varies over country as well as time. In equation (3.10), we would have a regression model with *i-1* country dummies and *t-1* time dummies. The model could be specified as follows:

$$\left(\frac{I}{S}\right)_{it} = a_o + a_1 country_1 + a_2 country_2 + ... + a_{24} country_{24} + \lambda o + \lambda_1 1988 + \lambda_2 1989 + ... + \lambda_{15} 2002$$

$$+ \beta_1\left(\frac{S}{Y}\right)_{it} + \beta_2\left(\frac{CA}{Y}\right)_{it} + \beta_3\left(\frac{Aid}{Y}\right)_{it} + \beta_4 open_{it} + \beta_5\tau_{it} + \delta_{it} + \varepsilon_{it} \quad \text{.....(3.10)}$$

Another type of fixed effects model has differential intercepts and slopes. This kind of model has intercepts and slopes that both vary according to the

country. To formulate this model, we would include not only country dummies, but also their interactions with the time-varying covariates equation (3.11)

$$\left(\frac{I}{Y}\right)_{it} = a_1 + a_2 country_2 + a_3 country_3 + ... + a_{25} country_{25} + \beta_2\left(\frac{S}{y}\right)_{2it} + \beta_3\left(\frac{CA}{Y}\right)_{3it}$$
$$\beta_4\left(\frac{Aid}{Y}\right)_{4it} + \beta_5 open_{5it} + \beta_6 country_2\left(\frac{S}{Y}\right)_{2it} + \beta_7 country_3\left(\frac{S}{Y}\right)_{2it} + ...$$
$$+ \beta_{29} country_{25}\left(\frac{S}{Y}\right)_{2it} + \varepsilon_{it} \quad \text{.....(3.11)}$$

In this mode, the intercepts and intercepts vary with the country. The intercept for country$_1$ would be a_1. The intercept for country$_2$ would also include an additional intercept, a_2, so the intercept for country$_2$ would be $a_1 + a_2$. The intercept for country$_3$ would include an additional intercept. Hence, its intercept would be $a_1 + a_3$. The slope for $\left(S/Y\right)_{it}$ with country$_2$ will be $b_2 + b_6$, while the slope for $\left(S/Y\right)_{it}$ with country$_3$ would be $b_2 + b_7$. The slope for the rest countries will be done accordingly. In this way, the intercepts and slopes vary with the country.

There is also a fixed effects panel model in which both intercepts and slopes might vary according to country and time. This model specifies *i-1* country dummies, *t-1* time dummies, the variables under consideration and the interactions between them. If all of these are statistically significant, there is no reason to pool.

Fixed Effect Hypothesis Testing

We may wish to hierarchically test the effects of the fixed effects model. We use the pooled regression model as the baseline for our comparison. We first test the group (country) effects. We can perform this significance test with an F test resembling the structure of the F test for R^2 change.

$$F_{groupeffects} = \frac{(R^2_{FEM} - R^2_{pooled})/(n-1)}{(1-R^2_{LSDV})/(nT-n-K)} \quad \text{.....(3.12)}$$

Here T = total number of temporal observations.

n = the number of groups.

and k = number of regressors in the model.

If we find significant improvements in the R^2, then we have statistically significant group effects. We also want to test for the time effects. This can be done by a contrast, using the first or last time point as a reference. We assume that the sum of the time effects is equal to zero. Referring to equation (3.9), we use a contrast, which is paired t-test between the reference and test value. Greene (2003) expresses equation (3.9) more generally as:

$$y_{it} = \alpha_i + \gamma_t + x'_{it}\beta + \varepsilon_{it} \quad \text{.....(3.13)}$$

In this formulation, the group effects are the $a_i s$ and the time effects are the $y_i s$.

One can obtain least squares estimates for y_s and x_s with:

$$\hat{y}_{it} = y_{it} - \bar{y}_i - \bar{y}_t + \bar{\bar{y}},$$
$$\hat{X}_{it} = x_{it} - \bar{x}_i - \bar{x}_t + \bar{\bar{x}}, \quad \text{..... (3.14)}$$

where the period specific and overall means are

$$\bar{y}_t = \frac{\sum_{i=1}^{n} y_{it}}{n}$$

and $$\bar{\bar{y}} = \frac{\sum_{i=1}^{n}\sum_{t=1}^{T} y_{it}}{nT}$$

Greene (2003) Formulates the time effect by:

$$\hat{\gamma} = c_t = (\bar{y}_t - \bar{\bar{y}}) - (\bar{x}_t - \bar{\bar{x}})'b \text{.....(3.15)}$$

we can test for group, time, and interaction effects, assuming that we have not consumed all of our degrees of freedom. We hope to see an improvement in the R^2 without a problem with autocorrelation. If the panels are unbalanced, adjustments to the total counts are made. By using $\sum_{i=1}^{n} T_i$ instead of nT to account for the total number of observations, proper variances and F tests are computed. Hence, the unbalanced panels are easy to accommodate.

Fixed effects estimators depend only on deviations from their group means, they are sometimes referred to as within-groups estimators (Davidson and MacKinnon, 1993). If the cross-sectional effects are correlated with the regressors, then the cross-sectional effects will be correlated with the group

means. Ordinary least squares estimation on the pooled sample would be inconsistent, even though the within groups estimator would be consistent. If, however, the fixed effects are uncorrelated with the regressors, the within-groups estimator will not be efficient. If there is only variation between the group means, then it would be permissible to use the between-groups estimator, but this would be inconsistent if the cross-sectional errors are correlated with the group means of the regressors (Davidson and MacKinnon, 1993).

Pros and Cons of Fixed Effects Hypothesis

Fixed effects models are not free from drawbacks. The fixed effects models may frequently have too many cross-sectional units of observations requiring too many dummy variables for their specification. Too many dummy variables may sap the model of sufficient number of degrees of freedom for adequately powerful statistical test. Moreover, a model with many such variables may be plagued with multicollinarity, which increases the standard errors and thereby drains the model of statistical power to test parameters. If these models contain variables that do not vary within the groups, parameter estimation may be precluded. Although the model residuals are assumed to be normally distributed and homogenous, there could easily be country-specific (group wise) heteroskedasticity or autocorrelation over time that would further plague estimation.

One of the most advantages of the fixed effects model is that the error terms may be correlated with the individual effects. If group effects are uncorrelated with the group means of the regressors, it would probably be better to employ a more parsimonious parameterization of the panel model.

The Random Effects Model

Greene (2003) calls the random effects model a regression with a random constant term. One way to handle the ignorance or error is to assume that the intercept is a random outcome variable. The random outcome is a function of a mean value plus a random error. But this cross-sectional specific error term v_i, which indicates the deviation from the constant of the cross-sectional unit (in this case, country) must be uncorrelated with the errors of the variables if this is to be modeled. The time series cross-sectional regression model is one with an intercept that is a random effect.

$$y_{it} = \beta_{oi} + \beta_1 x_{it} + \beta_2 x_{it} + e_{it}$$

$$\beta_{oi} = \beta_i + v_i$$

$$\therefore\ y_{it} = \beta_i + \beta_1 x_{it} + \beta_2 x_{it} + e_{it} + v_i \quad \text{.....(3.16)}$$

Under these circumstances, the random error v_i is heterogeneity specific to a cross-sectional unit - in this case, country. This random error v_i is constant over time. Therefore $E[V_i^2 / x] = \sigma_i^2$. The random error e_{it} is specific to a particular observation. For v_i to be properly specified, it must be orthogonal to

the individual effects. Because of the separate cross-sectional error term, these models are sometimes called one-way random effects models. Owing to this intra-panel variation, the random effects has the distinct advantage of allowing for time - invariant variables to be included among the regressors.

Specification Tests: The Quandary of Random or Fixed Effect Models

The Hausman specification test devised by Hausman (1978) is the classical test of whether the fixed random effects model should be used. The research question is whether there is significant correlation between the unobserved person-specific random effects and the regressors. If there is no such correlation, then the random effects model may be more powerful and parsimonious. If there is such a correlation, the random effects model would be inconsistently estimated and the fixed effects model would be the model of choice.

The test for this correlation is a comparison of the covariance matrix of the regressors in the LSDV model with those in the random effects model. The null hypothesis is that there is no correlation. If there is no statistically difference between the covariance matrices of the two models, then the correlations of the random effects with the regressors are statistically insignificant. The Hausman test is a kind of Wald χ^2 test with $K-1$ degrees of freedom (where K = number of regressors) on the difference matrix between the variance-covariance of the LSDV with that of the random effect model.

Let the covariance matrix of the difference vector, $[b-\hat{\beta}]$:

$$Var[b-\hat{\beta}] = Var[b] + Var[\hat{\beta}] - Cov[b,\hat{\beta}] - Cov[b,\hat{\beta}] \quad \text{.....(3.17)}$$

Hausman's essential result is the covariance of an efficient estimator with its difference from an inefficient estimator is zero, which implies that

$$Cov[(b-\hat{\beta}),\hat{\beta}] = Cov[b,\hat{\beta}] - Var[\hat{\beta}] = 0 \text{ or that}$$

$$Cov[b,\hat{\beta}] = Var[\hat{\beta}]$$

Inserting this result in (3.18) produces the required covariance matrix for the test,

$$Var[b-\hat{\beta}] = Var[b] - Var[\hat{\beta}] = \psi \quad \text{.....(3.18)}$$

the chi-squared test is based on the Wald criterion:

$$W : \chi^2[k-1] = [b-\hat{\beta}]'\hat{\psi}^{-1}[b-\hat{\beta}] \quad \text{.....(3.19)}$$

For $\hat{\psi}$, we use the estimated covariance matrices of the slope estimator in the LSDV model and the estimated covariance matrix in the random effects model, excluding the constant term. Under the null hypothesis, W has a limiting chi-squared distribution with $k-1$ degrees of freedom.

Model Specification

Models have to be estimated by methods that handle the problems afflicting them. A constant coefficients model with residual homogeneity and normality

can be estimated with ordinary least squares estimation (OLS). As long as there is no group wise or other heteroscedastic effects on the dependent variable, OLS may be used for fixed effects model estimation as well (Sayrs, 1989). For OLS to be properly applied, the errors have to be independent and homoscedastic. Those conditions are so rare that is often unrealistic to expect that OLS will suffice for such models (Davidson and Mackinnon, 1993).

Heteroscedastic models are usually fitted with estimated or feasible generalized least squares (EGLS or FGLS). Heteroscedasticity can be assessed with a white or Breusch-Pagan test. For the most part, fixed effect models with group wise heteroscedasticity cannot be efficiently estimated with OLS. If the sample size is large enough and autocorrelation plagues the errors, FGLS can be used. Random sampling and maximum likelihood iterated by generalized least squares have also been used (Greene, 2002). Beck and Katz (1995) reportedly found that if the sample size is finite or small, the total number of temporal observations must be as large as the number of panels; moreover they reportedly found that OLS panel corrected errors provided more efficient estimation than FGLS (Greenberg, 2003).

If the model exhibits autocorrelation and/or moving average errors, first differences (Wooldridge, 2002) or GLS corrected for ARMA errors can be used (Sayrs, 1989). Hausman and Taylor (1981) have used weighted instrumental variables, based only on the information within the model, for random effects estimation to be used when there are enough instruments for the modeling. The

instrumental variables, which are proxy variables uncorrelated with the errors, are based on the group means. The use of these instrumental variables allows researchers to circumvent the inconsistency and inefficiency problems following from correlation of the individual variables with the errors.

For dynamic panels with lagged dependent variables, Arellano, Bond, and Bover have used general methods of moments, which are asymptotically normal (Wooldridge, 2002). With greater number of moment conditions, they are able to handle some missing data and they can attain gains in efficiency as long as there are three or four periods of data (Greene, 2002).

Another estimation procedure was developed by Arnold Zellner, called seemingly unrelated regression (SUR) requires that the number of explanatory variables in each cross-section is the same. In the SUR approach, variables are transformed with a form of cochrane-orchutt correction to model the autocorrelation. Feasible generalized least squares is used to estimate a covariance matrix. The parameter estimates are also modeled. The process is iterated until the errors are minimized.

3.3. Panel Data Unit Root Tests

Testing for unit roots in time-series studies is standard practice amongst applied researchers and has become an integral part of econometric study. However, testing for unit roots in panel data is more recent. To access the degree of integration in our panel of data we employ the IPS unit root test as

presented by Im, Pesaran and Shin (1999). This specific test has been chosen over those presented by Levin and Lin (1992) and Maddala and Wu (1999) because it has better small sample properties and is more intuitive in its construction than the Levin and Lin (1992) test and also does not require Monte Carlo simulation-based p-values like the Madalla and Wu (1999) test.

Before going directly into testing unit roots using IPS test the basic underlining concepts of each of the panel data unit root tests are discussed below.

Levin and Lin (1992, 1993) (LL Test)

Using Harris and Sollis (2003) formulation and notations consider the model:

$$y_{it} = \rho_i y_{i,t-1} + Z'_{it}\gamma + u_{it}, i = 1,...N; t = 1,...,T \quad \text{.....(3.20)}$$

where Z_{it} is the deterministic component and U_{it} is stationary process. Z_{it} could be zero, one, the fixed effects, or fixed effect as well as time trend. Assuming that u_{it} is distributed IID $(0,\sigma^2)$ and $\rho_i = \rho$ for all i. Levin and Lin tests the null $H_o : \rho = 1$ against $H_a : \rho < 1$ (Baltagi and Kao, 2000; Hariss and Sollis, 2003). This test, however, is said to suffer from several limitations, including its assumption of homogeneous panel by setting $\rho_i = \rho$ for all i, the requirement that N/T tend to be zero, and significant size distortion in the presence of correlation among contemporaneous cross-sectional error terms Baltagi and Kao, (2000); Harris and Sollis, (2003).

Im, Pesaran and Shin (1997) Test (IPS Test)

The IPS (1999) test allows for heterogeneous coefficients of y_{it-1}, ρ_i, and different patterns of serial correlation and proposes an alternative test technique based on averaging individual unit root test statistics (Baltagi and Kao, 2000, Im, K, Pesaran, M. and Shin, Y, 1999). Let,

$$\Delta y_{it} = \alpha_i + \rho_i y_{i,t-1} + u_{it}, i = 1,..., N and t = 1,...,T \quad \text{.....(3.21)}$$

The null hypothesis $H_o : \rho_i = 1$ for all i, against $H_a : \rho_i < 1$ for at least one i. Allowing for serial correlation of the error term we have

$$u_{it} = \sum_{j=1}^{\rho i} \varphi_{ij} \Delta y_{i,t-j} + \varepsilon_{it}, \quad \text{.....(3.22)}$$ we can thus rewrite as:

$$\Delta y_{it} = \alpha i + \rho_i y_{i,t-1} + \sum_{J=1}^{\rho i} Y_{ij} \Delta y_{i,t-j} + \varepsilon_{it} \quad \text{.....(3.23)}$$

The IPS t-bar statistic is defined as the average of the individual ADF statistics as:

$$\bar{t} = \frac{1}{N} \sum t_{\rho i} \quad \text{.....(3.24)}$$ where $t_{\rho i}$ is the individual t-statistic of testing $H_o : \rho_i = 1$. It is shown that as $T \to \infty$ (for fixed value of N) followed by $N \to \infty$ sequentially, the IPS test statistics are asymptotically distributed as standard normal as;

$$t_{IPS} = \frac{\sqrt{N}(\bar{t} - E[t_{iT} / \rho_i = 1])}{\sqrt{Var[t_{iT} / \rho_i = 1]}} \Rightarrow N(0,1) \quad \text{.....(3.25)}$$

where $E[t_{iT} / \rho_i = 1]$ and $Var[t_{iT} / \rho_i = 1]$ are the mean and variance of t_i statistics which have been computed by IPS via simulation for different values of T and ρ', s (Baltagi and Kao, 2000).

Maddala and Wu (1999) Test (MW Test)

The model and the null hypothesis are similar to that of IPS. However, MW advocates the use of a Fisher type test that combines the significance level for rejecting the null (the p-value) obtained when estimating individual unit root tests (for e.g. using the ADF test) (see Harris and Sollis, 2003:196-197). The statistic is calculated as:

$$P = -2\sum_{i=1}^{N} \ln Pi \quad \text{.....(3.26)}$$

where P is distributed as χ^2 with $2N$ degrees of freedom, P_i are the p-values from unit root tests of cross section i. As noted in Baltagi and Kao (2000) and Harris and Sollis (2003), this test does not require balanced panel, it is possible to use different lag lengths in the individual ADF regressions and it can be applied to any other unit root tests.

CHAPTER FOUR

ANALYSIS AND EMPIRICAL RESULTS

4.1. Introduction

In this chapter, the estimation results that were the main concern of this study are presented. The correlation between saving and investment is estimated for the entire sample with the sample period of 1988-2003. Before analyzing the regression results, we make an important enhancement to Equation (3.1). Hanson (1992) and Montiel (1994) argue that the effect of foreign aid should be taken into account when estimating saving-investment correlations. To the extent that foreign aid is used for domestic investment it belongs to the Feldstein-Horioka regression because investment in many developing countries depends not only on domestic saving, but also on the amount of foreign aid. Ignoring foreign aid under such circumstances would render the investment function mis-specified. Furthermore, if only part of foreign aid is used for investment and the rest is used for, say, consumption, the measured saving rate would decrease and the coefficient of saving rate would be downward biased as a measure of the independent effect of saving on investment (Montiel, 1994). So, if foreign aid is important, but omitted, the correlation between saving and investment weakens, thus, implying more financial openness than is actually the case. Following this advice we therefore enhance Equation (3.1) by including CA, aid, openness and interactive dummies to weaken multicollinarity.

$$\left(\frac{I}{Y}\right)_{it} = \alpha_{it} + \beta_1\left(\frac{S}{Y}\right)_{it} + \beta_2\left(\frac{CA}{Y}\right)_{it} + \beta_3\left(\frac{Aid}{Y}\right)_{it} + \beta_4 open_{it} + \beta_5\tau_{it} + \beta_6\delta_{it} + \varepsilon_{it} \ldots\ldots\ldots 4.0$$

In section 4.2 the stationary panel data estimation results for the pooled, random effects and fixed effects models are presented in tables (4.3, 4.4 and 4.5) and finally, testing for unit roots are summarized.

4.2. Results from Regression Analysis

[a] Panel Unit Root Test

Research on panel unit roots and tests for stationarity is one of the frontiers in contemporary panel data econometrics. The distinction between stationary and non-stationary panel data can reflect, explicitly or implicitly, the economic or financial characteristics and attributes of the data, for example, if the current state or value of a variable is derived through accumulation of all previous increases (decreases as negative increases) in its value, then this variable is almost certainly non-stationary. If a variable is a relative measure, which has nothing to do with history, then it is more likely to be stationary, though non-stationary cannot be ruled out when there is non-trivial change in the rate (acceleration or deceleration).

Often in an empirical study, different panel unit root tests are used to investigate whether the variables are stationary or not. Panel unit root tests provide an overall aggregate statistic to examine whether there exists a unit root in the pooled cross-section time series data and to judge the time series

property of the data accordingly. This on the one hand, can avoid obtaining contradictory results in individual time series to which no satisfactory explanations can be offered. On the other hand, good asymptotic properties can be reached with relatively small samples in individual time series, which are otherwise too small to be estimated effectively. In the procedure developed by Levin and Lin (1992,1993), when the disturbances are independent identical distribution (i.i.d), the unit root t-statistic converges to the normal distribution; when fixed effects or serial correlation is specified for the disturbances, a straight-forward transformation of the t-statistic converges to the normal distribution too. Therefore, their unit root t-statistic converges to the normal distribution under various assumptions about disturbances. Due to the presence of unit root, the convergence is achieved more quickly as the number of time periods grows than as the number of individuals grows. It is claimed that the panel framework provides remarkable improvements in statistical power compared to performing a separate unit root for each individual time series.

Commenting on and summarizing the Levin and Lin (1992,1993) and the Im, Pesaran and Shin (1999) procedures, Maddala and Wu (1999) argue that the Levin and Lin test is too restrictive to be of interest in practice. While the test of Im, Pesaran, Shin (1999) relaxes Levin and Lin's assumptions, it presents test results which merely summarize the evidence from a number of independent tests of the sample hypothesis. It follows that, in addition to the discussion made in the previous chapter, although the null hypothesis is the same in the

two tests, the alternative hypothesis is different. The LLC tests are based on homogeneity of the autoregressive parameter, thus, the LLC tests are based on pooled regressions. The Im Pesaran, Shin test on the other hand, is based on heterogeneity of the autoregressive parameter. As argued earlier, the test amounts to a combination of different independent tests. There is no pooling of data involved as in the LLC tests.

Table-4.1: Panel Unit Root Test Results

Variable Name	In Levels						Fist Difference					
	LLC		IPS		MW		LLC		IPS		MW	
	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.	Stat.	Prob.
IR	-5.97570	0.0000	-3.69044	0.0001	86.9647	0.0009	-17.5180	0.0000	-12.9088	0.0000	221.026	0.0000
SR	-4.23209	0.0000	-3.29406	0.0005	85.0254	0.0015	-13.4274	0.0000	-12.0290	0.0000	211.4224	0.0000
CA	-8.87688	0.0000	-6.74362	0.0000	129.662	0.0000	-13.6669	0.0000	-12.7153	0.0000	223.163	0.0000
Aid	-4.71529	0.0000	-2.5134	0.0060	76.1660	0.0100	-17.4199	0.0000	-12.3968	0.0000	214.265	0.0000
Openness	-6.53823	0.0000	-3.59390	0.0002	87.0476	0.0009	-13.6835	0.0000	-10.3540	0.0000	186.063	0.0000
SA Dummy (τ_{it})	-0.42556	0.33352	-1.05496	0.1457	3.99860	0.1354	-0.21507	0.4149	-1.37967	0.0838	5.05570	0.0798
Time Dummy (δ_{it})	-6.61799	0.000	-4.21749	0.0000	94.8623	0.0001	-13.7368	0.0000	-11.4869	0.0000	198.051	0.0000

Table 4.1 shows the three panel unit root test results. From the table it can be concluded all alternative panel unit root test results is an I(0) variable. Again taking most of the tests, it is clearly seen that, variables involving in the

estimation of the capital mobility are an I(0) variables. Of all these unit roots tests, Im, Pesaran and Shin (1999) has been selected as it has aforementioned advantages over the rest. This implies the test uses the panel dimension of the data.

[b] Hausman Specification Test

Table-4.2: Hausman Specification Test Without τ_{it} : Hausman Fixed Random

Variable Name	Coefficient		b-B Difference	Sqrt(diag(V_b- V_B)) S.E.
	(b) Fixed	(B) Random		
SR	0.082705	0.1023864	-0.0196814	-
CA	-0.0006681	-0.0007899	0.0001218	-
Aid	0.0001641	0.0002027	-0.0000386	-
Open	0.0254056	0.025867	-0.0004614	0.0011056
δ_{it}	-0.1008773	-0.1044155	0.0035382	-

b = consistent under H_o and H_a; obtained from xtreg
B = inconsistent under H_a, efficient under H_o; obtained from xtreg
Test: H_o: difference in coefficients not systematic
Chi2(5)=(b-B)' [(V_b-V_B)^(-1)](b-B)
=-121.45
prob>CHi2=0.0000

The Test Suggests That the Appropriate Model is the Fixed Effect Estimation Model.

[c] The Pooled Model

The pooled estimation model is the most restrictive of all the specifications and does not acknowledge any cross-section heterogeneity within the Sub-Saharan region, assuming a common intercept for the whole panel. In table 4.3, the saving rate coefficient appears to be rather low at 0.067978 in line with similar studies on developing countries. The magnitude and negative sign for the current account ratio coefficient indicates that a substantial amount of funds have flown into the region. The significance of the aid ratio shows that it is an important source of finance for investment in the region while the openness variable supports the argument that a more open economy will be conducive to capital flows and higher investment rates. The insignificance of the South African interactive dummy is in this model implies that there is no difference in the saving rate structure between South Africa and the rest of the region. The time interactive dummy indicates that the mobility of capital increased throughout the time period.

Table-4.3: Pooled Regression Results in the Sub-Saharan Africa (1988 – 2003)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-0.014375	0.001781	-8.073235	0.0000
SR	0.067978	0.040992	1.658323	0.0981
CA	-0.000628	8.55E-05	-7.349741	0.0000
AID	0.000172	5.54E-05	3.103042	0.0021
OPEN	0.024976	0.002010	12.42569	0.0000
τ_{it}	7.334153	31.20468	0.235034	0.8143
δ_{it}	-0.101996	0.050049	-2.037931	0.0423
	Effects Specification			
Cross-section fixed (dummy variables)				
R-squared	0.920261	Mean dependent var		0.012982
Adjusted R-squared	0.913778	S.D. dependent var		0.024036
S.E. of regression	0.007058	Akaike info criterion		-6.995057
Sum squared resid	0.018380	Schwarz criterion		-6.685719
Log likelihood	1430.011	F-statistic		141.9523
Durbin-Watson stat	0.893092	Prob(F-statistic)		0.000000

Fixed Effects (Cross)

Country	Coefficient*
Benin	0.003184
Botswana	-0.013883
Burkina Faso	0.004530
Burundi	0.010805
Cameroon	0.000324
Central African republic	0.007854
Cote D'Ivoire	-0.010229
Ethiopia	-2.30E-05
Gabon	-0.008423
Gambia	0.035868
Kenya	-0.002547
Lesotho	0.028042
Madagascar	-0.002228
Malawi	-0.006865
Mali	-0.000202
Mauritania	0.001183
Mauritius	-0.013614
Niger	0.001683
Nigeria	-0.006754
Rwanda	0.004858
Senegal	-0.006745
Togo	-0.000507
Zambia	-0.020228
Zimbabwe	-0.003150
South Africa	-0.002933

R – Squared	0.920261
Adjusted R – Squared	0.913778
S. E. of Regression	0.007058
F – Statistic	141.9523
Prob (F – Statistic)	0.000000

* ***Individual Country's Coefficient Relative to the coefficient of the constant term.***

Once the pooled result is obtained in table 4.3, it is advisable to take advantage of the privilege of subtracting a constant from each country's variable coefficient to convert to the form most useful and most easily interpreted for the specific country effect. Using constant term as a base the 25 Sub-Saharan African countries in cross-section analysis across a period 1988 to 2003 has taken under consideration. The individual country's coefficient denotes unobservable individual effect. The result's obtained in table 4.3 are consistent with common expectations of variables coefficients with respect to capital mobility in Sub-Saharan African countries.

Hence, the results in table 4.3 shows that within Feldstein-Horioka framework capital can indeed be regarded as increasingly becoming more mobile through the years as a result of institutional and political reforms.

[d] The Random Effect Model

The random effect model also acknowledges the cross-section heterogeneity but differs from the fixed effect models in that it assumes that these effects are generated by specific distribution. Therefore, this model assumes cross-section differences but do not explicitly model each effect. The loss in degrees of freedom, as is the case in the fixed effects models, is subsequently avoided. Once again, the Wald Chi2 test for random effects (Greene 2000) clearly rejects the null of no cross-section heterogeneity in favor of the random effects specification.

Table-4.4: The Random Effect Model

Variable Name	With τ_{it}	Without τ_{it}
Constant	-0.0166653 (0.000) ***	-0.0167389 (0.0000) ***
SR	0.1015995 (0.021) **	0.1023864 (0.020) **
CA	-0.0007877 (0.000) ***	-0.0007899 (0.0000) ***
Aid	0.0002016 (0.000) ***	0.0002027 (0.000) ***
Openness	0.0258751 (0.000) ***	0.0258678 (0.0000) ***
SA dummy τ_{it}	-7.553229 (0.778)	-
Time dummy δ_{it}	-0.1047142 (0.047) **	-0.1044155 (0.047) **
R-Squared	0.7295	0.7200
Wald chi2(6)	550.33	
Wald chi2(5)		551.72

Notes: *- P: Values Reported in Parenthesis*

(***), (*\) and (*) *- Indicates Significance of the Coefficient or Rejection of the Null Hypothesis at 1%, 5% and 10% level of significance respectively.*

In table 4.4, the significant low saving rate coefficient of 0.1023864 without τ_{it} would then potentially indicate even higher capital mobility in the region than the previous models and places more emphasis on financial aid to generate investment with the highest coefficient of all the models, namely 0.0002027. The time dummy shows that the degree of capital mobility has increased from 1988, while the current account ratio coefficient indicates an inflow of investment fund into the region. Increasingly enough, although the model acknowledges cross-section heterogeneity, it does not indicate any difference in the savings rate coefficient of South Africa with that of the rest of the region.

To summarize, overall estimation results of the saving-investment relationship are consistent with the empirical findings of previous studies. We are, however, cautions to conclude that the robust low saving rate coefficient of between 0.1023864 and 0.082705 without τ_{it} indicates a high capital mobility in the region as suggested by the Feldstein-Horioka methodology. Rather, we are of the opinion that a number of reasons could explain a different conclusion.

Firstly, the sizable coefficients on the aid and current account ratios indicate the importance and dominance of aid and FDI flows in determining investment in the region, while a more open economy also enhances capital movements and investment rates.

Secondly, it is difficult to quantify and control for the degree of measurement error in the data due to unrecorded informal activity in these countries, potentially leading to downward bias in the correlation between saving and investment.

Moreover, similar to Hansen (1992) and Montiel (1994), one could argue that increase in consumption of foreign aid decreases the saving rate within these countries, exaggerating the downward bias of the saving rate coefficients. The consistently negative time interactive dummy may however be interpreted as an indication that institutional changes and policy aiming at financial deregulation has been successful. Our result also confirm that South African dummy (τ_{it}) is insignificant.

From a macroeconomic policy perspective, tax revenues are used to finance government purchase and to adjust capital market for capital mobility, accordingly our results suggest that taxes levied on domestic and foreign investment require special scrutiny.

[e] The Fixed Effects Model

This fixed effect model acknowledges cross-section heterogeneity and assumes a different intercept for each country included in a sample. It achieves this by including a matrix of dummies in the estimation in the case of the LSDV estimator. In the case of the within estimator, cross-section effects are wiped out, essentially estimating the same coefficients but running the regression through the origin. Fixed effects are in this case calculated by means of the first order conditions of least squares. Estimated coefficients are however the same, hence we report the result from the LSDV estimation in table 4.5.

The presence of these effects is apparent since the F test for fixed effects (Baltagi 2001:14) clearly rejects the null hypothesis of homogenous cross-sections. These fixed effects may represent differences in political, institutional and economic policy systems that are not explicitly included in the specification, but which is accounted for when estimation is done, ultimately leading to more representative estimates. This is evident from the fact that Hausman specification test table 4.2 suggest that the appropriate model is the fixed effect estimation model with out τ_{it}. For this reason we regard this model as our most representative and robust model specification.

Table-4.5: The Fixed Effect Model

Variable Name	With τ_{it}	Without τ_{it}
Constant	-.0147573 (0.000) ***	-0.0147994 (0.000) ***
SR	0.0825204 (0.051) *	0.082705 (0.050) *
CA	-0.000667 (0.000) ***	-0.0006681 (0.000) ***
Aid	0.0001639 (0.004) ***	0.0001641 (0.000) ***
Openness	0.0254449 (0.000) ***	0.0254056 (0.000) ***
SA dummy τ_{it}	-12.16787 (0.712)	-
Time dummy δ_{it}	-0.1008397 (0.047) **	-0.1008773 (0.046)
R-Squared	0.7096	0.7101
F-statistic	35.61	35.81

Notes: *- P: Values Reported in Parenthesis*
(***), (**) and (*) *- Indicates Significance of the Coefficient or Rejection of the Null Hypothesis at 1%, 5% and 10% level of significance respectively.*

It is evident from table 4.5, the saving coefficient of 0.082705 without τ_{it} is similar to that of the pooled model and would in the Feldstein-Horioka framework potentially imply a relatively significant degree of capital mobility in the region. The time interactive dummy shows that the changes that took place in terms of financial deregulation within the time period were successful in increasing the level of capital mobility. Once again the current account ratio coefficient of -0.0006671 without τ_{it} indicates that investment funds have flows into the region while financial aid with coefficient of 0.0021641 without τ_{it}

remains an important determinant of investment. The insignificance of the South African dummy in this model indicates that there is no difference in the saving rate structure between South Africa and the rest of the Sub-Saharan African countries.

Among the estimated models, Hausman fixed random test suggests that the appropriate model is the fixed effect estimation model.

CHAPTER FIVE

CONCLUSION, SUMMARY AND POLICY IMPLICATIONS

5.1. Conclusion and Summary

In this study the researcher used panel data estimation techniques to assess the level and driving forces of capital mobility in the Sub-Saharan African region. Due to the fact that these techniques incorporate both time-series and cross-section dimensions of the data, he increased the degree of freedom of the estimation, generating more representative coefficient estimates. Another important reason for using these techniques is the fact that we were able to acknowledge country heterogeneity, therefore capturing unobservable country-specific effects, once again resulting in superior estimates.

The researcher's estimation results have shown that, based on a variety of specifications using panel data econometric techniques, Sub-Saharan African countries display a low saving rate coefficient within the Feldstein-Horioka framework, which confirms results of previous empirical studies. The researcher's model specification however encompasses previous studies by including two interactive dummy variables to acknowledge the South African may have a different level of capital mobility and saving behavior than the rest of the Sub-Saharan African countries, as well as the fact that capital mobility may be changing over time.

The researcher's results show that within Feldstein-Horioka framework, capital can indeed be regarded as increasingly becoming more mobile through the years as a result of institutional and political reforms. A more open economy is also conductive to higher levels of investment. An alarming finding is the fact that, even though South Africa can be assumed as a developed country within the Sub-Saharan African countries with a different saving and investment structure than the rest of the countries, the finding shows that the insignificance of the South African interactive dummy in this model implies that there is no difference in the saving and investment rate structure between South Africa and the rest of the Sub-Saharan African countries. This unexpected result could be as a result of, the country's inheritance of a pile of trouble from the disintegrating apartheid government may frustrated the economy and raised inequality in the short-term. South African government allocates more money for a program of social grants, mainly for child support and pensions, which go to about 10 million people (out of a population of 47 million).

Chapter four shows, the investment rate of the Sub-Saharan African countries is very dependent and largely influenced by foreign finance and aid which shows that these countries are not able to mobilize their domestic resources to satisfy their investment needs.

The conclusion also suggests a new interpretation of Feldstein and Horioka's result. Obtaining a high coefficient of correlation in the cross-section, may be

less due to the existence of common characteristics affecting all the countries in the sample in the same way in a given period (imperfect capital mobility) than to the existence of specific individual country.

5.2. Policy Implications

From macroeconomic policy perspective, the magnitude and sign for the current account ratio coefficient in chapter four, indicates that a substantial amount of funds have flown into the region, to maintain this flow of funds and free movement of capital taxes levied on domestic and foreign investment requires special scrutiny. If taxes on capital investments are relatively high compared to the rest of the world, investors would demand higher yields on their investments, or simply extract funds and invest it in countries with better yield prospects.

Following the famous advice of Jean-Baptise Colbert, Louis XIV's treasurer: "The art of taxation consists in so plucking the goose as to obtain the largest possible amount of feathers with the smallest possible amount of hissing." Over the next few years globalization, accelerated by the internet, is likely to test the taxman's plucking skills.

The internet will make the goose harder to catch and noisier in defense of its plumage. Tax competition is likely to go. Even so, tax competition is unlikely to result in "a race to the bottom". As Tiebout (1956) argued, governments offering competitive packages of high quality services and high taxes may well attract

mobile tax payers, perhaps more successfully than governments offering minimal services and low taxes. But using taxes to redistribute wealth from mobile firms and people to the less mobile, and less well off, may become harder. Coping with globalization is likely to require considerable changes in the tax system over the next few years. Such changes almost always generate a good deal of political strife.

Government expenditure programmes should not only be aimed at improving and building financial and institutional infrastructures in efforts to generate domestic savings. Monetary autonomy, transparency and consistency are essential in creating investor confidence.

Many African countries have begun to realize the importance of attracting Foreign Direct Investment. Unfortunately, political and economic instability, sometimes corrupt and not impartial systems of justice, and over regulated policy environments in Africa do not inspire confidence among potential investors. In addition to addressing these fundamental problems, we would recommended that countries interested in further promoting foreign direct investment seriously consider establishing genuine one-step investment offices. By cutting through the red tape that foreign investors have to face a country can go a long way toward enhancing its attractiveness to potential investors. There is no substitute for basic potential and macroeconomic stability, but policies to cut red tape and delays can help.

From the analysis in chapter four, aid is the other variable which require special scrutiny. Foreign resource inflows allow countries to invest at a rate above that supportable by domestic saving alone. Such inflows require corresponding flows of equity or debt private capital flows follow investment.

Whatever the immediate motives for aid, the long-term development must be kept in view. Greater public accountability regarding uses of aid, as well as, as more public awareness of aid and development policy issues, in both donor and recipient countries is essential in defining consistent objectives for aid. Foreign aid can be important in assisting economies to fill in gaps in savings and foreign exchange and can be channeled into extremely useful areas such as human resource development, these are only short-term solutions. In the long run, aid can only be supplementary; a country cannot depend on aid in the long term. The effectiveness of foreign aid in helping an economy launch its own sustained development depends critically on how the aid is used. Aid is ineffective when used to postpone needed reforms.

To come to a conclusion, the potential for change and progress in Sub-Saharan African Countries is there. Unlocking Sub-Saharan African Countries potential requires effective economic policies. These critical policy areas for sustainable development are:

1. Macroeconomic stability,
2. Mobilization of savings, development of financial intermediation and incentives for productive investment,

3. Outward-orientation and attraction of direct foreign investment, and

4. Effective management of foreign exchange resources and incentives to potential producers of foreign exchange.

Future research should seek to determine the precise nature of the flows that lead to a breakdown of the Feldstein-Horioka result for Sub-Saharan African countries one large source of capital inflows for low and middle income Sub-Saharan African countries is linked to aid and current account. From the viewpoint of outflows, debt repayments pay a crucial role. The volume of these inflows and outflows is often large relative to the size of domestic investment and savings. Hence, such sources of capital flows might drive much of our empirical findings.

By following the Feldstein-Horioka tradition, it has only been possible to present information on the aggregate levels of saving and investment within an economy. A comprehensive survey of the changing structure of the markets that become the channels for savings and investment activity will have to wait for another time. On the basis of Feldstein-Horioka coefficients alone, the most interesting avenue for future research would seem to be the strategic use which governments make of the image of globalization in circumstances in which change is not necessarily globalizing nature.

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Annex-1: Data Description and Sources

Series (Variable)	Description	Source
GDP	Gross Domestic Product	WB-ADI*
GDI	Gross Domestic Investment	WB-ADI
GDS	Gross Domestic Saving	WB-ADI
Exp.Med.	Merchandise Export	WB-ADI
Exp.Ser.	Exports of Total Service (non factor and factor)	WB-ADI
Im.Mer.	Merchandise Import	WB-ADI
Im.Ser.	Imports of Total Service	WB-ADI
IR	Gross Capital Formation (Gross Domestic Investment) as a ratio of GDP	WB-ADI
SR	Gross Domestic Saving as a Ratio of GDP	WB-ADI
CA	Current Account Balance as a Ratio of GDP	WB-ADI
Aid	Net Official Development Aid (ODA) from all Donors as a Ratio of GDP	WB-ADI
OPEN	Total Export Plus Total Import Divided by GDP	WB-ADI
SA Dummy	South African Dummy	Trade Liberalization Date
Time Dummy	Time Dummy	Trade Liberalization Date
SA Interactive Dummy τ_{it}	Saving Rate Times SA Dummy	Own Calculation
Time Interactive δ_{it}	Saving Rate Times Time Dummy	Own Calculation

* WB-ADI: World Bank African Development Indicator

Annex-2: List of Countries Included in the Sample

Country	Abbreviated Name
Benin	Ben
Botswana	Bots
Burkina Faso	Burk
Burundi	Buru
Cameroon	Cam
Central African Republic	CAR
Cote D'Ivoire	CotI
Ethiopia	Eth
Gabon	Gab
Gambia	Gam
Kenya	Ken
Lesotho	Les
Madagascar	Mad
Malawi	Mal
Mali	Mali
Mauritania	Mrtia
Mauritius	Mrits
Niger	Niger
Nigeria	Nga
Rwanda	Rwa
Senegal	Sen
South Africa	SA
Togo	Togo
Zambia	Zam
Zimbabwe	Zim

Annex-3: Pool Descriptive Statistics

	IR	SR	τ_{it}	δ_{it}	CA	AID	OPEN
Mean	0.012982	0.001420	8.02E-06	0.002177	-7.112175	12.20200	0.835026
Median	0.006323	0.002074	0.000000	0.001619	-6.550000	11.15000	0.681523
Maximum	0.162677	0.041096	0.000311	0.041096	16.80000	95.20000	3.272016
Minimum	0.000112	-0.172829	0.000000	-0.100203	-88.40000	-0.300000	0.210837
Std. Dev.	0.024036	0.018060	4.09E-05	0.011228	9.879130	10.29613	0.524527
Skewness	3.832708	-6.381054	5.299673	-3.774997	-3.463742	2.149367	1.853594
Kurtosis	18.53297	55.66549	31.12491	35.69447	24.36155	14.46238	7.119232
Jarque-Bera	5000.530	48942.09	15055.95	18765.51	8405.101	2497.755	511.8553
Probability	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Sum	5.192821	0.568080	0.003208	0.870825	-2844.870	4880.800	334.0104
Sum Sq. Dev.	0.230506	0.130133	6.69E-07	0.050303	38941.29	42298.12	109.7763
Observations	400	400	400	400	400	400	400
Cross sections	25	25	25	25	25	25	25

Annex-4: Regression Results for the Fixed Effects Model

. xtreg ir sr ca aid open τ_{it} δ_{it}, fe

Fixed-effects (within) regression		Number of obs	= 380
Group variable (i): country		Number of groups	= 25
R-sq: within = 0.5341		Obs per group: min	= 10
between = 0.7453		avg	= 15.2
overall = 0.7096		max	= 16
		F(6,349)	= 66.69
corr(u_i, Xb) = 0.2946		Prob > F	= 0.0000

ir	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sr	.0825204	.0421645	1.96	0.051	-.000408	.1654488
ca	-.000667	.0000912	-7.31	0.000	-.0008464	-.0004876
aid	.0001639	.0000567	2.89	0.004	.0000523	.0002754
open	.0254449	.0020789	12.24	0.000	.0213561	.0295337
τ_{it}	-12.16787	32.98725	-0.37	0.712	-77.04668	52.71094
δ_{it}	-.1008397	.050543	-2.00	0.047	-.2002469	-.0014325
_cons	-.0147573	.0018053	-8.17	0.000	-.018308	-.0112066
sigma_u	.01187021					
sigma_e	.00711524					
rho	.73567055	(fraction of variance due to u_i)				

F test that all u_i=0: F(24, 349) = 35.61 Prob > F = 0.0000

Annex-5: Regression Results for the Random Effects Model

. xtreg ir sr ca aid open τ_{it} δ_{it}, re

Random-effects GLS regression		Number of obs	= 380
Group variable (i): country		Number of groups	= 25
R-sq: within = 0.5329		Obs per group: min	= 10
between = 0.7603		avg	= 15.2
overall = 0.7195		max	= 16
Random effects u_i ~ Gaussian		Wald chi2(6)	= 550.33
corr(u_i, X) = 0 (assumed)		Prob > chi2	= 0.0000

ir	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
sr	.1015995	.0439934	2.31	0.021	.015374	.187825
ca	-.0007877	.0000931	-8.46	0.000	-.0009702	-.0006052
aid	.0002016	.0000575	3.51	0.000	.0000889	.0003142
open	.0258751	.0017569	14.73	0.000	0224318	.0293185
τ_{it}	-7.553229	26.81232	-0.28	0.778	-60.10442	44.99796
δ_{it}	-.1047142	.0526523	-1.99	0.047	-.2079109	-.0015175
_cons	-.0166653	.0020666	-8.06	0.000	-.0207157	-.0126148
sigma_u	.00561985					
sigma_e	.00711524					
rho	.38417446	(fraction of variance due to u_i)				

Annex-6: Hausman Specification Test for Fixed Random

. xtreg ir sr ca aid open τ_{it} δ_{it} , fe

Fixed-effects (within) regression
Group variable (i): country

R-sq: within = 0.5341
between = 0.7453
overall = 0.7096

corr(u_i, Xb) = 0.2946

Number of obs = 380
Number of groups = 25

Obs per group: min = 10
avg = 15.2
max = 16

F(6,349) = 66.69
Prob > F = 0.0000

ir	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sr	.0825204	.0421645	1.96	0.051	-.000408	.1654488
ca	-.000667	.0000912	-7.31	0.000	-.0008464	-.0004876
aid	.0001639	.0000567	2.89	0.004	.0000523	.0002754
open	.0254449	.0020789	12.24	0.000	.0213561	.0295337
τ_{it}	-12.16787	32.98725	-0.37	0.712	-77.04668	52.71094
δ_{it}	-.1008397	.050543	-2.00	0.047	-.2002469	-.0014325
_cons	-.0147573	.0018053	-8.17	0.000	-.018308	-.0112066
sigma_u	.01187021					
sigma_e	.00711524					
rho	.73567055	(fraction of variance due to u_i)				

F test that all u_i=0: F(24, 349) = 35.61 Prob > F = 0.0000

. estimates store fixed

. xtreg ir sr ca aid open τ_{it} δ_{it}, re

Random-effects GLS regression
Group variable (i): country

R-sq: within = 0.5329
between = 0.7603
overall = 0.7195

Random effects u_i ~ Gaussian
corr(u_i, X) = 0 (assumed)

Number of obs = 380
Number of groups = 25

Obs per group: min = 10
avg = 15.2
max = 16

Wald chi2(6) = 550.33
Prob > chi2 = 0.0000

ir	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
sr	.1015995	.0439934	2.31	0.021	.015374	.187825
ca	-.0007877	.0000931	-8.46	0.000	-.0009702	-.0006052
aid	.0002016	.0000575	3.51	0.000	.0000889	.0003142
open	.0258751	.0017569	14.73	0.000	.0224318	.0293185
τ_{it}	-7.553229	26.81232	-0.28	0.778	-60.10442	44.99796
δ_{it}	-.1047142	.0526523	-1.99	0.047	-.2079109	-.0015175
_cons	-.0166653	.0020666	-8.06	0.000	-.0207157	-.0126148
sigma_u	.00561985					
sigma_e	.00711524					
rho	.38417446	(fraction of variance due to u_i)				

Contd...

Contd...

. estimates store random

. **hausman fixed random**

	Coefficients			
	(b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
sr	.0825204	.1015995	-.0190791	.
ca	-.000667	-.0007877	.0001207	.
aid	.0001639	.0002016	-.0000377	.
open	.0254449	.0258751	-.0004302	.0011115
τ_{it}	-12.16787	-7.553229	-4.614643	19.21609
δ_{it}	-.1008397	-.1047142	.0038745	.

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test: Ho: difference in coefficients not systematic

chi2(3) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= -5.52 chi2<0 ==> model fitted on these data fails to meet the asymptotic assumptions of the Hausman test; see suest for a generalized test

Annex-7: Regression Results for the Fixed Effect Model Without τ_{it}

. xtreg ir sr ca aid open δ_{it}, fe

Fixed-effects (within) regression		Number of obs	= 380
Group variable (i): country		Number of groups	= 25
R-sq: within = 0.5340		Obs per group: min	= 10
between = 0.7464		avg	= 15.2
overall = 0.7101		max	= 16
		F(5,350)	= 80.20
corr(u_i, Xb) = 0.3001		Prob > F	= 0.0000

ir	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sr	.082705	.0421094	1.96	0.050	-.0001144	.1655243
ca	-.0006681	.000091	-7.34	0.000	-.0008471	-.000489
aid	.0001641	.0000566	2.90	0.004	.0000527	.0002755
open	.0254056	.0020736	12.25	0.000	.0213273	.0294839
δ_{it}	-.1008773	.0504805	-2.00	0.046	-.2001606	-.001594
_cons	-.0147994	.0017995	-8.22	0.000	-.0183385	-.0112602
sigma_u	.01187529					
sigma_e	.00710645					
rho	.73631698	(fraction of variance due to u_i)				

F test that all u_i=0: F(24, 350) = 35.81 Prob > F = 0.0000

Annex-8: Regression Results for the Random Effect Model Without τ_{it}

. xtreg ir sr ca aid open δ_{it}, re

Random-effects GLS regression — Number of obs = 380
Group variable (i): country — Number of groups = 25

R-sq: within = 0.5327 — Obs per group: min = 10
between = 0.7612 — avg = 15.2
overall = 0.7200 — max = 16

Random effects u_i ~ Gaussian — Wald chi2(5) = 551.72
corr(u_i, X) = 0 (assumed) — Prob > chi2 = 0.0000

ir	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
sr	.1023864	.0438569	2.33	0.020	.0164284	.1883444
ca	-.0007899	.0000927	-8.52	0.000	-.0009716	-.0006082
aid	.0002027	.0000573	3.54	0.000	.0000904	.0003149
open	.025867	.0017543	14.75	0.000	.0224287	.0293053
δ_{it}	-.1044155	.0525802	-1.99	0.047	-.2074709	-.0013601
_cons	-.0167389	.0020477	-8.17	0.000	-.0207524	-.0127254
sigma_u	.00560973					
sigma_e	.00710645					
rho	.38390579	(fraction of variance due to u_i)				

Annex-9: Hausman Specification Test Without τ_{it} for Fixed Random

. xtreg ir sr ca aid open δ_{it}, fe

Fixed-effects (within) regression
Group variable (i): country

R-sq: within = 0.5340
between = 0.7464
overall = 0.7101

corr(u_i, Xb) = 0.3001

Number of obs = 380
Number of groups = 25

Obs per group: min = 10
avg = 15.2
max = 16

F(5,350) = 80.20
Prob > F = 0.0000

ir	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
sr	.082705	.0421094	1.96	0.050	-.0001144	.1655243
ca	-.0006681	.000091	-7.34	0.000	-.0008471	-.000489
aid	.0001641	.0000566	2.90	0.004	.0000527	.0002755
open	.0254056	.0020736	12.25	0.000	.0213273	.0294839
δ_{it}	-.1008773	.0504805	-2.00	0.046	-.2001606	-.001594
_cons	-.0147994	.0017995	-8.22	0.000	-.0183385	-.0112602
sigma_u	.01187529					
sigma_e	.00710645					
rho	.73631698	(fraction of variance due to u_i)				

F test that all u_i=0: F(24, 350) = 35.81 Prob > F = 0.0000

. estimates store fixed

. xtreg ir sr ca aid open δ_{it}, re

Random-effects GLS regression
Group variable (i): country

R-sq: within = 0.5327
between = 0.7612
overall = 0.7200

Random effects u_i ~ Gaussian
corr(u_i, X) = 0 (assumed)

Number of obs = 380
Number of groups = 25

Obs per group: min = 10
avg = 15.2
max = 16

Wald chi2(5) = 551.72
Prob > chi2 = 0.0000

ir	Coef.	Std. Err.	z	P>|z|	[95% Conf.	Interval]
sr	.1023864	.0438569	2.33	0.020	.0164284	.1883444
ca	-.0007899	.0000927	-8.52	0.000	-.0009716	-.0006082
aid	.0002027	.0000573	3.54	0.000	.0000904	.0003149
open	.025867	.0017543	14.75	0.000	.0224287	.0293053
δ_{it}	-.1044155	.0525802	-1.99	0.047	-.2074709	-.0013601
_cons	-.0167389	.0020477	-8.17	0.000	-.0207524	-.0127254
sigma_u	.00560973					
sigma_e	.00710645					
rho	.38390579	(fraction of variance due to u_i)				

Contd ...

Contd...

. estimates store random

. hausman fixed random

	Coefficients (b) fixed	(B) random	(b-B) Difference	sqrt(diag(V_b-V_B)) S.E.
sr	.082705	.1023864	-.0196814	.
ca	-.0006681	-.0007899	.0001218	.
aid	.0001641	.0002027	-.0000386	.
open	.0254056	.025867	-.0004614	.0011056
δ_{it}	-.1008773	-.1044155	.0035382	.

b = consistent under Ho and Ha; obtained from xtreg
B = inconsistent under Ha, efficient under Ho; obtained from xtreg

Test:: Ho: difference in coefficients not systematic

chi2(5) = (b-B)'[(V_b-V_B)^(-1)](b-B)
= 121.45
Prob>chi2 = 0.0000

THE TEST SUGGESTES THAT THE APPROPRIATE MODEL IS THE FIXED EFFECT ESTIMATION MODEL.

Declaration

I, the undersigned, declare that this thesis is my original work and has not been presented for a degree in any other university, and that all source of materials used for the thesis have been duly acknowledged.

Declared by:

Name: NEMERA GURMESSA

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Confirmed by Advisor:

Name: Dr. Ch. Baranwal

Signature: _____

Date: 02/08/06

Place and date of submission: _____.