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Retirement schemes and economic growth in sub-Saharan countries: a panel data analysis

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To

My Father and Mother

Your absence is part of my inspiration

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Summary

Retirement Schemes and Economic Growth in Sub-Saharan African Countries: A Panel Data Analysis

By

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Degree: PhD in Economics

An understanding of the rationale for providing retirement schemes, their principal functions and different methods of financing them is crucial to structuring and implementing sustainable retirement schemes in sub-Saharan African (SSA) countries. The fact is that the structure of economies in this part of the world is very different from that in the developed world, in that an official social net barely exists. In the developed world most countries have some or other a form of provision for retirement for the elderly. They are provided through systems like Pay-As-You-Go (PAYG) or other forms, such as pension and provident funds, social grants, etc.

However, the provision of social security in a PAYG system entails costs that are transmitted through generations. These costs arise from the methods governments use to finance the benefits promised to individuals while they are economically active. Generally, government finances the expenditure on social security obligations through current taxes

(contributions), which are levied from individuals working at present to pay the benefits to retirees. The assumption is that the population and the economy grow at the same rate. However, the reality is quite different and it often happens that revenue from current contributions is not sufficient to finance the required social security expenditure. This is especially the case where the ageing population is not replaced by a corresponding population growth.

Nevertheless, in most Sub-Saharan African Countries (SSA) the ageing of the population does not present an immediate problem. Therefore, the social security systems of these countries constitute different problems than those of the developed world. In the majority of SSA countries, social security faces the problem of outdated legislation with no provision for adjustment of cost of living (real replacement rates are very low) and in some other countries the provision of social security has only recently been implemented. Therefore, there is an urgent need to reform retirement programs in SSA countries, but these reforms do not necessarily imply privatisation and should preferably be implemented within existing programs. An example of reform is the introduction of a principal-agent type of management with clear management rules. To accompany this process, these countries should establish institutions for monitoring and law enforcement. At the same time they should promote the development of financial and capital markets as a necessary condition for having sustainable and attractive retirement programs.

Factors like underdeveloped financial and capital markets, adverse selection problems (intensified by low literacy rates (on average less than 54 per cent)), moral hazard and low per capita income, prevent the majority of the populations in SSA countries to find alternative ways of saving for retirement. Moreover, the growing migration of the young population in search of better living conditions has weakened the traditional or safe family social security structures and therefore, worsened the socio-economic conditions of the elderly population, especially in the rural areas. The growing and prosperous informal sector also has to be considered when policymakers rethink social security in the African continent.

The need for policymakers in the African continent to rethink current social security structures is fuelled by research results confirming that social security plays an important

role in the performance of economies. World Bank reports in 1994 in particular, proposed different ways of managing retirement programs and a three pillars system was suggested. One possibility is a system managed by government (similar to the present PAYG system), the second privately managed (individual accounts) and the third voluntary saving (personal saving through financial institutions, real estates, etc.). However, the debate regarding proposed reforms continues and it seems that the optimal solution is still to be devised. Research indicates that in the case of SSA countries, it is recommended that reforms start within existing systems. There are various reasons for this idea. Firstly, due to the high uncertainty of output, new systems could have far reaching macroeconomic implications. Secondly, microeconomic effects on the demand side of the economy could influence the labour market due to the availability of abundant and cheap labour. Thirdly, bailout politics are abundant in many SSA countries, which may weaken privately managed social security programs (like individual accounts).

This study analysed 14 SSA countries using panel data. The results indicate that social security programs positively affect saving in the SADC countries, but in West Africa and the full country sample, savings is affected negatively. These results have important policy implications in that West African countries need to reform their current social security systems in such a way, that they contribute to saving and the development of financial and capital markets. In the SADC countries, however, more emphasis should be placed on the development of financial and capital markets. The study finds adverse results in the growth model. In the pooled model social security crowds-out growth in per capita GDP in West African countries, but it crowds-in growth in per capita GDP in the SADC countries as well as in the full country sample. These results confirm the findings of other studies namely that no conclusive results exist with regard to the effect of social security on the performance of economies.

The model results indicate that social security has a positive effect on fertility. Thus, the results contrast the widely accepted claim that social security reduces fertility on the basis that parents tend to rely less on children as a source of income during their retirement if the social net takes care of them. This phenomenon could be caused by the perception that social security in its current format in SSA countries does not have the potential to replace children as a source of income during retirement. Another factor that may influence this

result is because of low coverage rates, the preference of many excluded individuals, mainly in the rural areas and informal sector, is still to rely on their children as a source of old age security.

Finally, the study concludes that in sub-Saharan African countries policymakers have to pay more attention to institutional arrangements that would accommodate the implementation of a proper social security system. The starting point should be reforms of existing retirement schemes. Reforms should be initiated within the existing schemes, through the introduction of the principal-agent management model with strong regulation and monitoring to ensure sound management principles. The informal sector poses a major challenge and should be included in a social security system also allowing competition from possible providers of social security products to the informal sector.

The redesign of retirement schemes should be aimed at regional integration with scale economies to be captured both at country and regional levels. This implies that the number of operators in the industry should also be considered to avoid excessive costs related to marketing and the administration of the funds. Another important conclusion is that retirement reform programs should form part of the overall strategies of poverty alleviation currently being implemented in many sub-Saharan countries.

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Chapter 1

1.1 Introduction

An understanding of the rationale for providing retirement schemes, their principal functions and different methods of financing them is crucial to structuring and implementing sustainable retirement schemes in sub-Saharan African (SSA) countries. The fact is that the structure of economies in this part of the world is very different from that in the developed world, in that an official social net barely exists. In the developed world most countries have some or other a form of provision for retirement for the elderly. They are provided through systems like Pay-As-You-Go (PAYG) or other forms, such as pension and provident funds, social grants, etc.

The PAYG system has been under increasing scrutiny due to its strain on the public budget especially in view of changes in the demographic structure in developed countries. These changes have created a gap between contributions from the PAYG system and the benefits necessary to pay for the retiring generation. This gap increases the government deficit and subsequent debt to finance the necessary expenditure. The continuous rise in government debt to pay benefits to retirees has caused the sustainability of PAYG systems in the developed world to be questioned. As a result many alternative or complementary methods to this system were proposed. However, they all involve shifting costs, that is, the cost of moving away from the PAYG system to alternative systems or to establishing a new system that complements the PAYG system.

A shift away from the PAYG system to possible alternatives requires careful evaluation of the cost-benefits this will entail. One view is that individuals may become more responsible about their old age provision and another is that individuals remain myopic and cannot foresee what will happen to them if they do not save for retirement. While the first view is valid for economies where individuals may have rational expectations, the second seems to be the more likely approach. There are two possible reasons for the latter behaviour, namely:

(i) Individuals are simply myopic and they disregard the importance of saving for retirement and (ii) Low income prevents individuals from behaving rationally, they simply cannot save.

The second reason seems to be applicable to most sub-Saharan African economies. The disposable income of the majority of people living in these countries does not enable them to save for old age. Many have to survive on less than one US dollar per day. This suggests that a mandatory PAYG system may be appropriate for these countries, which requires small contributions from individuals supported by contributions from employers.

Changes in the structure of the population do not affect sub-Saharan Africa as it does developed countries. Low per capita income however, prevents the PAYG system to raise sufficient revenue to pay for the required benefits to retirees. The debt governments need to incur to finance retirement benefits may have "back warding" effects on their economies, similar to the effects that changes in the demographic structure have on developed countries.

Government debt emanating from borrowing to finance retirement programs with a concomitant increase in interest rates, constrain the formation of productive capital. High interest rates and lower investment in the productive sector reduce the level of equilibrium output. If the population continues to grow at a steady state rate, then the government will be forced to either raise taxes or debt to finance retirement benefits, thereby further constraining the budget. Moreover, it is argued that contributions to retirement funds reduce savings due to both income and substitution effects during the life cycle of the individual. These effects severely impact the relevant countries (mainly developing ones) with serious financial resource constraints. In these countries retirement funds should be treated as the most important asset of an individual, since his/her capacity to save for retirement is very low. In order to implement appropriate retirement systems in sub-Saharan African economies, the difficulties of balancing their budgets and considering the effects of retirement programs on the economy, need to be carefully analysed. Through the application of econometric panel data techniques, this study attempts to reveal the specific effects of retirement programs on the growth of a selected number of economies in SSA.

The selection criteria are determined by the availability of data and only countries with at least 10 years of data available on benefit payments were selected.

This study contains eight chapters. The first chapter presents an introduction, defines social security in the context of this study, explains the problem statement, objectives, significance and the limitations of the study and defines the hypothesis to be tested. The second chapter discusses the available social security programs in sub-Saharan Africa, including qualifying conditions for benefit payments and a regulatory framework. It also presents the different savings alternatives to a retirement system. The third chapter provides a literature review of the impact of retirement schemes on issues like saving, economic growth and fertility. The fourth chapter discusses the theoretical framework, including the effect on the economy of different methods of financing retirement systems. Chapter 5 presents the model specifications and discusses the advantages of using panel data as econometric tool, as well as the source of the data used in the study. Chapter 6 presents the results of the study as well as the results of bootstrapping and finally, Chapter 7 draws some policy implications, based on the research results, with some recommendations.

1.2 Defining Social Security

The principal objective of social security programs is to provide individuals with income that allows them to meet their basic needs, like food, housing, health care, etc. at a time when income is insufficient. It can also provide benefits in kind, in addition to monetary benefits, in the form of food stamps, child grants, etc. This definition is in line with the European Union definition of social protection expenditure which states that: Social security protection…"*encompasses all interventions from public or private bodies intended to relieve households and individuals of the burden of a defined set of risks and needs, provided that there is neither a simultaneous reciprocal nor an individual agreement involved*" (ESSPROS, 1996:12)[1]. This is a broader definition of social security

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[1] ESSPROS means European System of Integrated Social Protection Statistics)

coverage, which can be sub-divided into many other narrower definitions depending on the focus of the study or government program.

In this research social security takes the narrower definition by only considering the provision of income for the aged, in other words retirement benefits. Thus, hereafter, social security means retirement benefits. Such benefits result from contributions (compulsory or mandatory) of individuals during their lifetime earnings. These are generally levied as a tax on a worker's wages in a pay-as-you-go system, which may or may not allow benefits to spouses and/or children. Employers generally also add to these employee contributions.

Social security narrowly defined may include pensions and provident and retirement annuity funds. In some countries with multiple retirement schemes, it is difficult to disaggregate data from different retirement schemes, because it is only presented in aggregate form. This causes difficulties when studying the effects of the individual retirement schemes in the economy. Therefore, in this study there is no distinction between different retirement schemes.

1.3 Justification of the Study

Since its introduction in 1891 by Bismark in Germany, retirement programs have been implemented in many countries. The motivation for the introduction of retirement schemes to provide for old age, arose from the observation that many individuals suffered during their retirement due to of lack of income to finance their needs. In the United States, the principal motivation for the implementation of retirement funds was to provide for those elderly individuals who had suffered loss of income during the 1930s depression and World War II, and who were not able to save enough for their retirement (Kotlikoff, 1987). In many developing countries retirement funds were introduced by former patrons (colonisers) and they took the shape of the social security regulation of the mother country. Thus, social security is not a new concept or practice to many developing countries, especially African ones. However, what is lacking in these countries is

successful practices that could serve as role model for policy design with regard to retirement programs.

In September 1994, The World Bank published a report entitled "*Averting the Old Age Crisis*" with the objective to evaluate the status of old age security around the world. The report notes that in many countries, particularly in developing ones, aged individuals suffer after they have retired. Explanations for this phenomenon include:

1. In some countries no pension scheme exists,

2. Deficient institutional structures constrain the provision of old age support,

3. In other countries contributions paid by workers during their lifetime earnings are deficiently managed, reducing the payouts of funds for retired individuals to becoming negative, with moral hazard[2] at the origin of deficient management,

4. In many developing countries, particularly African ones, government intervention and a poor investment portfolio may result in low benefit payouts that consequently discredit the system.

5. Excessive government intervention may also lead to mismanagement because retirement funds are easily accessible and at lower interest rates than the market rates, which may result in negative returns on the funds' investment.

6. Generous benefits may have distortionary effects on the economy, leading for example to early retirement which reduces the supply of experienced labour.

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[2] Moral hazard is defined as actions of economic agents in maximizing their own utility to the detriment of others, in situations where they do not bear the full consequences or, equivalently, do not enjoy the full benefit of their actions due to uncertainty and incomplete or restricted contracts, which prevent the assignment of full damages (benefits) to the agent responsible (this is a externality problem). This actions cause divergence between private social costs of some action and social cost of that action, resulting in an allocation of resources which is not optimal (The MIT Dictionary of Modern Economics, 1992). Therefore, moral hazard arises due to opportunistic behaviour of economic agents in the act of maximising their own utility.

7. The sustainability of a pay-as-you-go system is questionable since it may require relatively high taxes or debt to be paid by future generations to provide the benefits promised to the elderly generation.

8. Evasion of social security contributions due to high taxes and poor benefits paid may be encouraged.

In view of the problems identified, the World Bank Report proposed changes to social security systems. They recommended that given the relatively large youthful population of African countries and the disfunctionality of social security systems (many of them designed only for public employees, excluding the majority of the population) should redesign their social security programs. They should also take cognisance of the impact of such systems on economic growth and human capital formation.

The Report proposed three pillars for social security programs: firstly, a program (first pillar) runs by government, with (i) a redistributive function and (ii) serving as insurance for possible losses from market operations. Secondly, a privately managed program, with the objective to improve the benefits received during retirement through highly profitable investments. Thirdly, personal saving, which is voluntary for those who want improved levels of benefits. The Report recommended that the first two programs be mandatory but with a strong regulatory system to ensure that individual managers do not misuse the contributions channelled into these funds. Against this background, an attempt has been made to evaluate the state of existing social security schemes in sub-Saharan African countries, especially the way in which such schemes have performed in terms of their contribution to economic growth and investment in human capital.

Figures 1- 4 show how social security, economic growth rates, fertility net of mortality (represented as population growth) and saving have evolved over time in a selected number of sub-Saharan African countries. Social security and saving are expressed as ratios of GDP (Gross Domestic Product).

Figure 1 shows the retirement benefit payments to GDP ratios to illustrate the evolution of retirement benefit payments from the existing retirement schemes in sub-Saharan African countries. It can be seen from the figure that except for South Africa (SA) and Mozambique (MOZ), the ratio of retirement benefit payments to GDP in all other countries included in the analysis were almost constant. In the case of South Africa the ratio increased over the first four years of the sample period, remained steady over the following three years and then kept declining up to the end of the sample period (2003).

In the case of Mozambique the ratio increased over the full sample period. In 1994, Nigeria had the highest retirement benefit payments to GDP ratio but it declined over the following four years after which it kept fluctuating.

Figure 1: Retirement benefits/GDP ratio (1994-2003)

BEN=Benin; IVC=Ivory Cost; GNA=Ghana; Mali=Mali; SA=South Africa; MOZ=Mozambique and NGA=Nigeria

This suggests differences in policy treatment for retirement programs in different countries in the sample. As far as the rest of the countries included in the sample is concerned, the ratios remained fairly constant.

Figure 2: Growth rates in GDP per capita (1994-2003)
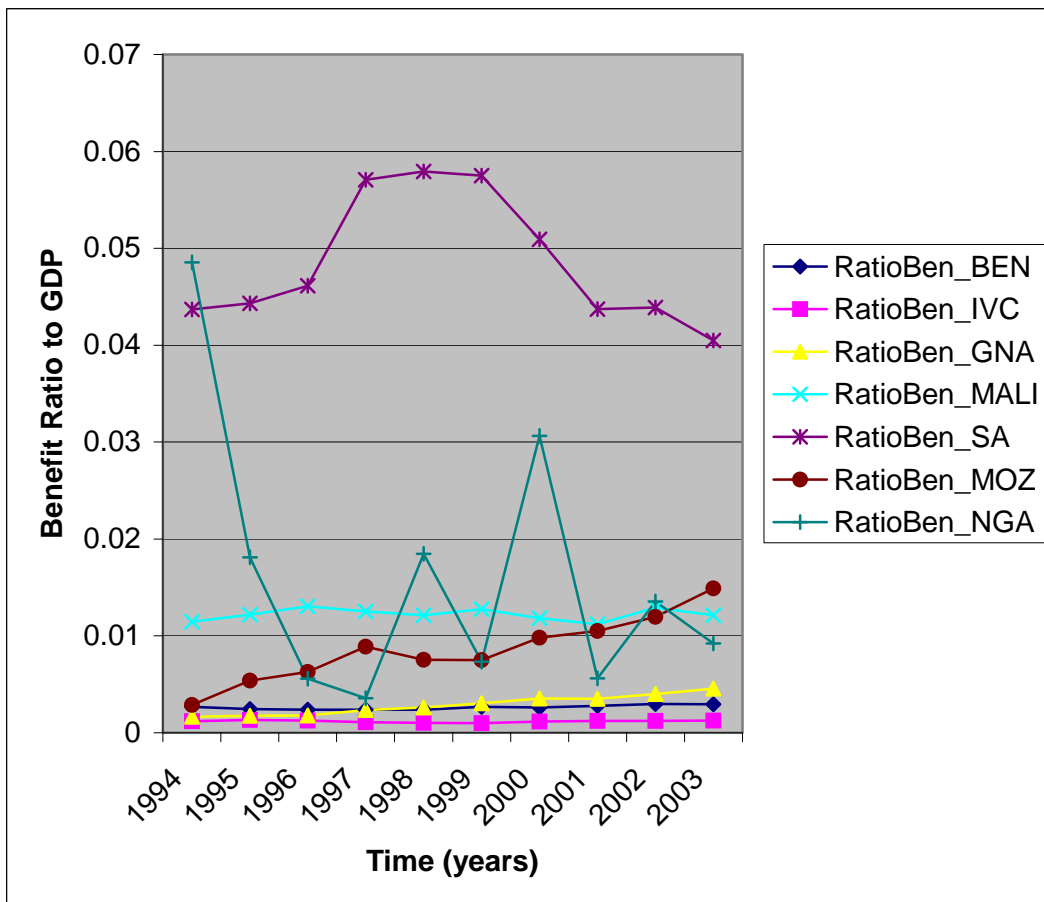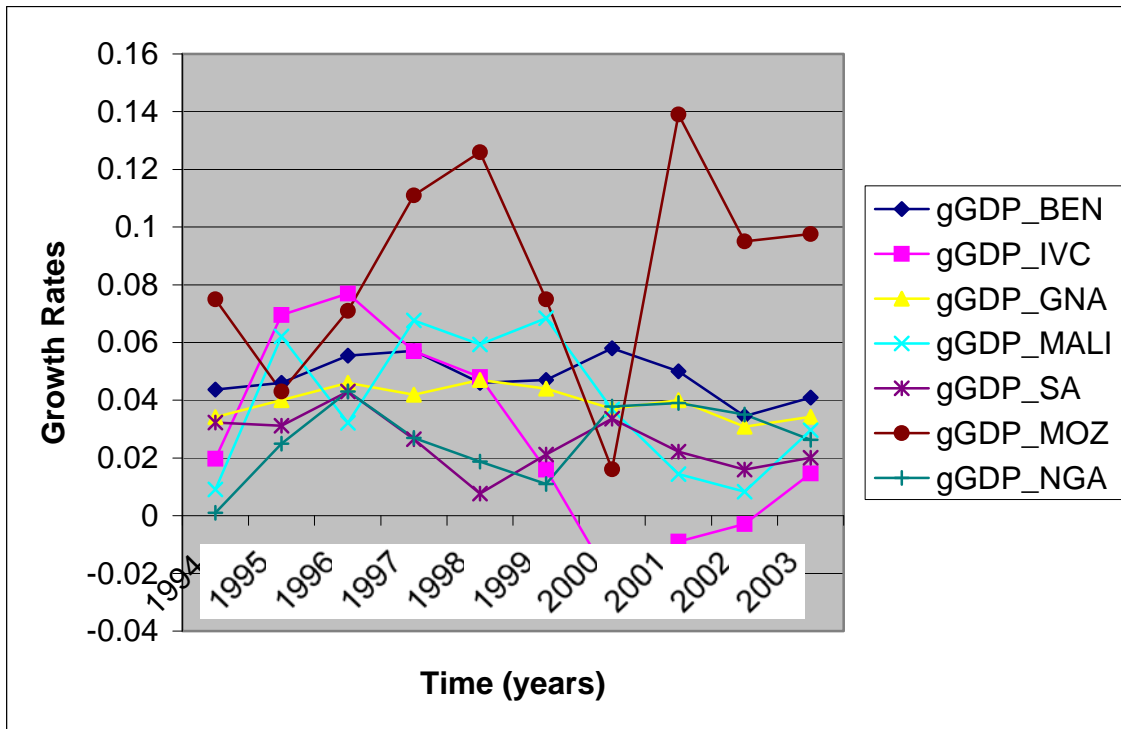
Source: IMF Country Report and World Development Indicators (2004 CD-ROM)

In Figure 2, the economic growth rates of the countries included in the analysis are portrayed. The majority of the countries show large fluctuations suggesting that the per capita growth GDP in these countries was unstable, except for Benin (BEN) and Ghana (GNA) in whose cases growth remained almost constant over the full sample period.

In Figure 3, by contrast, fertility rates (represented as the growth rate of the population) show decreasing tendencies in all countries. This scenario is similar to all other countries in the study. The effects of retirement programs on fertility rates and investment in human capital are an important consideration.

Figure 3: Fertility rates over the period 1994-2003

Figure 4: Investment/GDP ratio over the period 1994-2003

Figure 4 shows that similar to the retirement benefit to GDP ratios, investments as a proxy of saving have been growing strongly in Mozambique and Mali. In Benin they increased slightly over the period under study, while in all other countries the investment to GDP ratio remained almost constant.

Based on these tendencies the question is whether a correlation exists between retirement benefits paid and the macro variables outlined, namely: per capita GDP growth rates, fertility rates and investment as proxy of saving.

1.4 Problem Statement

This study seeks to understand and explain in the sub-Saharan African context, how the establishment of sound retirement schemes could contribute to economic growth, saving and reducing fertility rates. It investigates how the extension of retirement programs (also the growing informal sector) could contribute to poverty during retirement. The results should heighten the awareness of policymakers in SSA countries regarding the importance of retirement schemes in the performance of their economies such as its impact on the development of capital markets and consequently economic growth.

 A significant number of studies (World Bank, 1994; Hu, 1979; Orszag and Stiglitz, 1999; Beck and Levine, 2004; Walker and Lefort, 2002 and Barrell, Davis and Pomerantz, 2004) show that in the United States, Chile (which serves as a model for reforming retirement schemes) and economies in transition, that the implementation of proper retirement schemes has had a positive effect on poverty alleviation amongst the aged and contributed substantially to the development of capital markets. Other studies that attempted an investigation of the relationship between social security and economic growth, include James (1998a and 1996), Beck and Levine (2004), World Bank (1994), Corsetti and Schmidt-Hebbel (1997) and Hu (2004). The question is do these phenomenon also applies to the SSA countries?

1.5 Objectives of the Study

The objectives of this study are: (i) to determine the impact of retirement funds in SSA countries on savings, economic growth and fertility using a panel data analysis; (ii) to identify possible factors that may affect the performance of retirement funds, such as lack of credible institutional arrangements; (iii) to raise awareness with policymakers in SSA countries regarding the impact that retirement programs may have on the performance of their economies. Awareness should especially be raised regarding poverty alleviation, which is a fundamental factor to economic growth and development. Lastly (iv) to analyse the way in which the growing informal sector in all sub-Saharan African countries could be involved in retirement programs, as part of poverty alleviation strategies aimed at both retirees and their dependants. This is also important in view of the high rates of unemployment in all SSA countries and for an integrated strategy of economic growth in the NEPAD or regional development programs.

1.6 Significance of the Study

Retirement funds constitute an important means of providing income to sustain the needs of the elderly and disabled. For many years governments have been providing retirement programs through a pay-as-you-go system. However this system, while still used in many countries, places a heavy burden on the budget, with tax revenue mostly insufficient to honour the required obligations for retirement expenditure. Because of this burden, governments may resort to public debt, issuing long-term bonds or raising taxes to finance this retirement expenditure.

Large government deficits and debts further contribute towards fiscal vulnerability and volatility. In addition they cause instability in social spending programs including retirement schemes. Because government does not accumulate funds for retirement benefits, depending on how these expenditures are financed, the provision thereof may have important policy effects on the economy.

Financing retirement benefits through deficits or taxes may have varying economic implications. One such is future generations having to bear the burden of providing for retirement of present generations due to the latter lack of saving. However, in the SSA case this seems to be unavoidable at present due to potentially high transaction costs, given the low income levels that prevent individuals to save for retirement. Underdeveloped capital markets also constrain the private sector from entering the retirement industry. Thus, government has to take the lead in the provision of retirement benefits through a mandatory PAYG scheme.

One of the aims of this study is to alert policymakers in SSA countries of the impact that policies directed at provision for retirement may have on the course of the economy. In addition to emphasising the importance of formulating this policy, the study is also meant to fill the gap in literature regarding economic growth and retirement programs in the sub-Saharan African countries. As confirmed by Zhang and Zhang (2004) few studies have been published that investigate the relationship between economic growth and retirement funds using a panel data analysis in SSA countries.

1.7 Hypothesis

As stated earlier, retirement programs contribute towards economic growth and reduce fertility rates if parents are willing to invest more in their children's education. This implies that the provision of retirement benefits could also contribute to human capital formation (Ehrlich and Kim, 2005). However, other studies (Kotlikoff, 1987; Feldstein, 1974, 1995; Nhabinde and Schoeman, 2005) have shown that the existence of social security programs reduces other forms of savings (such as discretionary saving) that could constrain economic growth. Thus, in this study three different but interrelated hypotheses are being tested namely:

1. The availability of retirement benefits reduces saving in sub-Saharan African countries

2. Retirement benefits contribute towards economic growth in SSA countries

3. The availability of retirement benefits reduces fertility in SSA countries

1.8 Limitations

As in many other studies involving developing countries and African countries in particular, a major limitation is the availability of data. Moreover, the fact that the majority of SSA countries have retirement programs only for civil servants and some major public enterprises, may limit the generalisation of the results found in this study. In addition, the presence of a wide range of institutional regulations as well as (mostly outdated) provident funds and social insurance[3], further constrains the generalisation of the results form this research. The problem is exacerbated when countries with similar schemes have different policies for retirement funds' investments, which may result in significant differences in benefit payments. Furthermore, corruption may also affect the performance of retirement funds, resulting in benefit payments that do not correctly reflect the history of contributions and the income generated by retirement funds. Another major limitation arising from the data is the lack of consistence in recording data series reflected in the limited data series and the many gaps in between.

In summary the differing and wide range of regulations, data recording, corruption and the fact that retirement programs in the majority of African countries were designed for only a limited segment of the population (civil servants and major public enterprises) may constitute the biggest limitations in the generalisation of results found in this study.

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[3] Social insurance programs are designed to support individuals (workers) during periods of low or loss of income; for example, unemployment and retirement periods. These programs tend to have a specific duration, for example, the duration of unemployment or retirement and they are bounded by specific rules that individuals must satisfy in order to qualify for such programs. They are generally financed by tax contributions defined by laws on social security (or social insurance) programs in a specific country. Social insurance programs differ from social assistance programs in that in order to qualify an individual may not need to have contributed to a certain scheme for a specified period. Social assistance programs generally are non-contributory and provided by governments through general taxation and benefits are generally means-tested, in-kind benefits or any other form. These programs are designed to protect individuals from social exclusion; therefore, their aim is poverty alleviation.

Chapter 2: Literature Review

Since their introduction by Bismarck in Germany in 1891, retirement programs have been widely implemented worldwide. Bismarck's main objective was to provide old age retirees with a certain standard of living, thus assuring that individuals' income does not drop below a certain minimum level after retirement. The rapid growth of retirement programs since then (in number and quality of services) provides important evidence that individuals are risk averse, as they grow older. Hagemejer (2000) provides a list of nine risks and needs covered by a broad range of social protection expenditures, of which retirement benefits take a major slice (40 per cent) of these expenditures. Next the rationale and functions of social security schemes available are investigated.

2.1 The Rationale and Functions of Retirement Programs

Social security in the narrow definition of retirement programs basically entails the financing of retirement. Individuals receive benefit payments in the form of annuities during retirement until they die, allowing for a total or partial lump sum at the retirement date. Many of the retirement programs allow for surviving spouses and/or children to receive annuity benefits (Kotlikoff, 1987). The value of the benefits varies from one individual to another depending on the extent of their lifetime earnings. Retirement benefits are also paid to disabled individuals, providing for longevity, due to uncertainty of time of death. This uncertainty allows for possible substitution effects between lump sum (the one sum benefit from social security) and annuities.

Retirement programs also provide an important vehicle for intergenerational transfer of wealth. The PAYG system involves an efficient intergenerational transfer of resources if it is assumed that the economy follows Solow's (1956) model of balanced growth or Samuelson (1958) and Diamond's (1965) models of golden rule. The balanced growth or golden rule implies that once population growth has equalised to the growth in capital, government does not have to resort to debt under the PAYG system. In this case population growth is assumed to raise sufficient tax revenue to pay the benefits of retirees. This implies that the growth rates of wages and other outputs are equalised to the growth

rate of the population implying the Pareto equilibrium where all generations (present and future) are better off.

In the steady state economy it is assumed that government accumulates sufficient trust funds to pay for retired individuals, which in reality is not the case. In addition, population, capital, output and wages do not grow at the same rates, which means that the economy cannot maintain the golden rule or balanced growth of output. The result is that there is a surplus or deficit in the government collected tax revenue, implying higher or lower saving in the economy as in Solow's (1956) model. If an economy saves more it accumulates more capital than the population growth and, therefore, wages increase more rapidly. More taxes can be collected for social security purposes and the government need not resort to debt to finance retirement obligations, with the result that future generations are better off. The reverse is true if the economy saves less, in which case the government is forced to resort to debt to finance expenditure on social security. It is evident that social security is to some extent closely related to government deficit, resulting in future generations bearing the burden of lack of savings of present generations (Kotlikoff, 1987). All this provides the rationale (covering risk) and the function (improving the society's status) of retirement funds.

Inadequate private saving (Diamond, 1977) and purchases of life insurance (Auerbach and Kotlikoff, 1986) provide an important incentive for government intervention in order to secure social security and ensure that the economy continues to follow its growth path[4]. Inability in foreseeing the future health status of an individual obviously complicates the provision of social security to provide for all the different kinds of risks and needs. These difficulties also limit private insurance companies to provide products that would cover such risks, which raises the problem of adverse selection[5]. It is also argued that retirement

[4] The term "Growth path" substitutes "steady state", since the economy may not be growing at its steady state growth rate. In this case the provision of social security by government may guarantee that the economy continues growing at the actual growth path and eventually in the long-run follows its steady state growth rate (but with no guarantee).

[5] Adverse selection arises when a sub-population select a product that is likely to have less favourable characteristics than the population in general, for example a premium rate for life insurance may be fixed using the age-specific mortality rates for the population as a whole (The MIT Dictionary of Modern Economics, 1992). This concept implies that though the buyer and the seller of a product rank products of

funds contribute toward a Pareto improvement of the society by allowing intergenerational transfers of wealth with a risk sharing arrangement (Kotlikoff, 1987). Another reason for the introduction of social security systems as known today is the failure of family insurance systems to provide for old age security (Ehrlich and Lui, 1998). This is especially true of SSA countries where modest economic growth rates accompanied by many other exogenous factors have resulted in large scale migration of the labour force to other regions. The result is that traditional safe family insurance structures were weakened, and formal social security systems have become more viable[6].

2.2 A brief overview of retirement schemes around the world

In this paragraph an overview is presented of different social security systems in a number of selected countries. Old age security is featured by a variety of complex systems around the world and varying from country to country. However, most of these retirement schemes tend to be similar in nature regarding the form of administration and provision of old age income. The characteristics of each of these systems have evolved over time and with the changing demographic patterns since the late 1970s and early 1980s, developed countries were induced to reconsider the efficiency of their systems by reforming them (in some case in-depth reforms) to take into account the changing characteristics of their population. The majority of such reforms took place during the 1980s and 1990s but the process is still continuing.

In the majority of these countries social security systems tend to be dominated by PAYG defined benefit systems administered by government with contributions subsidised through tax incentives and payment of benefits includes a means-tested procedure. The problem with this type of social security system is that it constrains government finances

different quality in the same way, only the seller can observe the quality of each product he/she sells. The buyer can at most observe the distribution of the quality of goods previously sold. Without some device for the buyers to identify good products, bad products will always be sold with the good products (The MIT Dictionary of Modern Economics, 1992). Such a market illustrates the problem of adverse selection, which interferes with the effective operation of a market (Dictionary of Economics, 1987). Therefore, the problem of adverse selection arises due to asymmetric information between the sellers and the buyers.

[6] However, there are many factors that may affect the viability of social security schemes in most of the SSA countries, including the institutional setup among other factors as discussed in Chapter 3.

which could impose large implicit debts. However, in most recent years countries have been considering alternative forms of social security systems in order to reduce the strain on government finances. In this regard there has been a significant move of social security types, most of them designed to be of the PAYG type, to a new model of social security administration with the objective of lessening the burden both on government finances and the tax obligation on future generations. This section considers the existing social security schemes around the world and where possible reforms will also be reported.

2.2.1 Chile

The first Chilean social insurance system was introduced in 1924 (being the first country in the Americas to introduce social insurance). The Chilean system consists of a mandatory individual account, social insurance and social assistance system. The new system includes mandatory private individual accounts which were compulsory for workers entering the labour force as from December 31, 1982. It covers all private-sector employees, provides voluntary coverage to the self-employed, a wage earners' program with a minimum wage of 127,500 pesos, a salaried employees' program with special systems for railroad employees, seamen and port workers, public-sector employees, the armed forces, police and more than 30 other occupations (www.socialsecurity.gov).

The funds come from a mandatory individual account with the insured person contributing 10 per cent of gross earnings for old-age plus 0.75 per cent for disability and survivor insurance and an average of 1.55 per cent of gross earning for administrative fees. The employer does not contribute to any of these accounts, except 1 or 2 per cent of gross earnings for employees working under arduous conditions. For social insurance the insured person contributes 18.8 per cent of wages, while salaried employees contribute from 20 to 30 per cent of gross earning depending on the nature of occupation (a reduction of 7.75 per cent is granted to some workers with at least 40 years of contributions) and the employer is not required to contribute to this system (www.socialsecurity.gov).

Chile has the most cited reforming social security system, with a funded defined contribution (FDC) introduced in 1981 considered to be the most important development.

This FDC system is considered to have had a strong influence on the course of social security systems in the rest of the world. By the 1970s this scheme had covered about 70 per cent of the labour force (Williamson, 2005). The crisis the scheme experienced by late 1970s induced the Chilean government to divide it into separate PAYG plans each with its own rules with respect to eligibility and benefit levels. For example, full pension benefits after 35 years of contributions for some categories of workers and 30 years for government employees (Kitzer, 2000; Williamson, 2005; Myers, 1992). Williamson (2001) indicates that by 1980, the Chilean government was subsidising 28 per cent of pension payments. The new Chilean scheme is basically a fully funded scheme, but Williamson (2000) prefers to define it as a mixed or partially funded model since government still is contributing towards the funding of the system.

For new employees and also those who opted to shift from the old system to the FDC the contribution of wages is 10 per cent. This contribution is made to one of several privately management pension companies of their choice with an additional fee of between 2 and 3 per cent to such companies to cover the management costs and also to pay for survivors and disability insurance (Williamson, 2000). For employees covered by the old scheme (pre-1981 PAYG) who agreed to switch to the new scheme, employers had to increase wages by 18 per cent to ensure a real income increase of 11 per cent (Williamson, 2000; Kritzer, 1996).

The most recent changes in the Chilean FDC scheme include the 1999 reform with a shift from the use of 12 months to a 36 month accounting period when assessing compliance with rate return regulations (Williamson, 2000; Kritzer, 2000). In 2000 another reform was to allow asset managing companies to introduce a second fund (Fund 2) in addition to Fund 1 (the pre-existing fund) (see Williamson, 2000). Fund 2 was only for those who were within 10 years of retirement allowing for investment in fixed-income securities (Kritzer, 2002). In 2002 multi-funds were introduced in order to allow flexible investment in other markets such as the stock market that were not allowed before. These multi-funds encompass higher risk choices and lower risk choices of investment allowing workers to choose among the available investment alternatives.

2.2.2 United Kingdom

Old-age pension scheme (social insurance and social assistance system) was introduced for the first time in the UK in 1908 while in 1911 and 1925, disability insurance and old-age and survivors' insurance schemes respectively were introduced. The current laws on retirement were introduced in 1992 (consolidated legislation), in 1995 pensions, in 1999 welfare reforms and pensions and in 2000 child support, pensions, and social security. It covers all persons aged 16 to 65 (men) or aged 16 to 60 (women). The source of funds is from contributions by insured persons (11 per cent) and employers (12.8 per cent), with self-employed and voluntary contributions also allowed (www.socialsecurity.gov).

The United Kingdom (UK) state pension scheme is three-tiered: the basic state pension, the state earning-related pension scheme (SERPS) and the income support and invalidity benefits. The first tier of the state pension is a flat-rate contributory benefit payable to people aged 65 for men and 60 for women. The individual meets the qualifying conditions if he/she has made contributions to the National Insurance Fund for 90 per cent of their working lives but since the introduction of Home Responsibilities Protection act in 1978 the number of years of contributions can be reduced by the time spent on caring for children or dependents (Blundell and Emmerson, 2003). By April 2003, the basic state pension was worth £7.45 a week for a single pensioner. Before 1978 married women were allowed to opt to pay only a reduced amount to National Insurance Fund and, therefore, did not qualify for the basic state pension. Since 1989 there has not been an earnings test for a basic state pension.

Introduced in 1978 the SERPS scheme pays a pension equal to a proportion of an individual's annual earnings per year. The intention is to pay a pension worth one-quarter of the contributor's best twenty years of earnings, up to a specific upper earnings limit. Women who opt for a reduced payment to the National Insurance Fund do not qualify for the SERPS scheme (Blundell and Emmerson, 2003). However, widows can currently claim their husbands' SERPS pension in full if they receive no additional pension in their own right. SERPS pension is updated each year after retirement in line with inflation.

Another state benefit paid to elderly non-workers is an income support and incapacity grant. The income support grant is a non-contributory means-tested benefit payable to those aged 60 and above who fall into the lower income groups (Blundell and Emmerson, 2003). The beneficiaries of this flat-rate means-tested benefit are not required to show that they are not actively seeking work in order to qualify. In 1999, the income support was renamed to a minimum income guarantee. The generosity of the means-tested benefits was extended with the introduction of a pension credit in October 2003, payable to lower income individuals aged 65 and above (Blundell and Emmerson, 2003).

While the minimum income guarantee is non-contributory, an incapacity benefit was introduced in 1995 as a contributory benefit paid to the long-term sick and disabled and can be paid only to individuals aged under the state pension age. During the 1980s the rapid growth in receipts motivated the change from invalidity benefits to incapacity benefits, which before April 2001, did not follows the means-tested benefit procedure and could be received in conjunction with private pension income. However, since then means-tested benefit payments are applicable regard to individual occupational pension income (Blundell and Emmerson, 2003; www.socialsecurity.gov).

The reforms to SERPS introduced in 1986 and 1995 reduced its generosity for those qualifying for state pension after 2000. This reform came along with a choice to individuals to opt out of SERPS to join the defined contribution scheme from 1988 or individual retirement accounts (Blundell and Emmerson, 2003; www.socialsecurity.gov). Members of the defined benefit and contribution occupational schemes pay a reduced rate of National Insurance while those with personal stakeholder pensions receive a National Insurance rebate paid directly into their funds. There was a decline in coverage of occupational pension plans from 11 million to 10.1 million between the mid-1980s and 2000. According to Blundell and Emmerson (2003) such a decline reflects the employment patterns and a shift to smaller employers, but also the wide range of pension choices among individuals working for employers offering occupational pensions.

Most of the reforms introduced in the UK retirement schemes were meant to improve the social status of the aged and also reduce the generosity of existing schemes. Moreover, these reforms offered possibilities for working individuals to choose among the different retirement schemes and, therefore, giving individuals the chance to change schemes if not

satisfied. Such behavioural responses to reforms are currently considered in a number of studies with some implicating that an increase in the retirement age would lead to a significant increase in government revenue ((Blundell and Emmerson, 2003).

2.2.3 Sweden

In Sweden social security programs started with a universal and social insurance system which was later transformed into a unified social insurance and individual notional and mandatory individual accounts system. The first scheme of this nature (first law) was introduced in 1913. In 1999, a new system of social insurance notional accounts plus a mandatory individual premium pension accounts system were established. The old Swedish system covered all employed and self-employed people earning in excess of 40,100 kronor a year. The new system covers all individuals and self-employed people earning above 17,800 kronor a year and all residents qualify for a guaranteed pension (both old and new systems). The funds are sourced from insured persons (7 per cent of assessable income up to 341,300 kronor) for old age insurance; the self-employed contribute 7 per cent of assessable income (up to 341,300 kronor) plus 10.21 per cent of assessable income for old age insurance and 1.70 per cent of assessable income for survivor pension. The employer contributes 10.21 per cent of its payroll to old-age pension, plus a 1.7 per cent of the payroll to survivors. The government bears the total cost of guaranteed pension and permanent disability benefits and it also pays earnings-related benefits to government civil servants (www.socialsecurity.gov).

The old system provided individuals with a minimum protection in the form of a flat rate basic pension for all and various grants to those without income or low income groups. The earnings-related pension was provided for by a PAYG scheme which covered earnings up to a certain maximum (Scherman, 1999). The benefit payments under the old PAYG system implied pension indexation to inflation rather than economic growth, which caused severe financial problems, making it unsustainable.

Due to such unsustainability the Swedish parliament passed a law in June 1998 introducing a new old-age pension system which implemented in January 1999

(Scherman, 1999). However, according to Scherman, reforms in Sweden already started in the mid-1980s, with the abolition of a long life widows' pension which was replaced by a temporary adjustment pension for both widows and widowers and an improved child pension scheme. Under the reformed system the old-age system is separated from disability pensions. The new old-age system contains an earnings-related part that provides protection to those with no or only a low earnings-related pension (Scherman, 1999; www.socialsecurity.gov). The new public earning-related scheme encompasses two parts namely, a PAYG and a fully funded scheme financed through a 16 per cent tax contribution plus a contribution to the premium reserve scheme of 2.5 per cent (www.socialsecurity.gov).

The new Swedish PAYG system is considered to be less generous than the old system which makes it more sustainable with an indefinite and stable contribution rate playing a more significant role than the old system (Scherman, 1999).

2.2.4 Denmark

The problems facing the Danish universal, social insurance and mandatory individual account system are similar to those in other developed countries, that is, Denmark faces major future demographic changes of which it has to take care. The first retirement scheme (first law) dates back to 1891 with disability being legislated in 1921. The current laws on retirement schemes include the labour-market supplementary pension (ATP) of 1964, with a 1998 amendment (special pension saving scheme, SP) implemented in 1999 and a 2000 amendment implemented in 2002. Also, the 1984 law on universal old-age and disability pensions as amended in 1986 (partial early retirement pension with amendments) (www.socialsecurity.gov).

The universal pension covers resident citizens aged 16 to 66 (aged 16 to 69 as from July, 2004) as well as non-citizens meeting the minimum residence requirements. The labour-market supplementary pension (ATP) scheme covers employees 16 to 66 (aged 16 to 69 as from July 2004), including persons on partial leave or recipients of cash sickness or unemployment benefits. The special pension saving (SP) scheme covers employees aged

16 to 66 (age 16 to 69 as from July 2004), including persons on partial leave, recipients of cash sickness or unemployment benefits and the self-employed. The funds are sourced from an insured person up to a maximum of 894 kronor per year for a full-time worker if on the ATP program. Contributions of one per cent of gross income to the SP program were suspended for 2004 and 2005. Employers contribute 1,788 kronor per employee per year (full-time worker) if on the ATP. The government bears the cost of a universal basic pension scheme (www.socialsecurity.gov).

The Danish social security system is a mixed public-private sector arrangement, with the labour market-related program open to those 60-66 years old. The universal program (National Old-Age Pension – OAP) is a means-tested program based on employment earnings (Bingley, Gupta and Pedersen, 2005) and individuals are entitled to this program if older than 67 years. The 1999 reforms reduced the official retirement age from 67 to 65 with the objective to increase the average actual retirement age (currently 61.5 years).

The reforms in the Danish retirement schemes seem to be motivated by the expected changes in its demographic structure and also to increase the average actual retirement age. It is expected that in 2040 the dependency ratio in Denmark will decrease from 4 to about 2.5 per individual older than 65 years, with an expected strong effect on government finances (Bingley, Gupta and Pderson, 2005).

2.2.5 Australia

The Australian social assistance and mandatory occupational pension system was firstly introduced in 1908 with the objective to take care of the old-age and disabled and in 1942 it was extended to take care of widows as well. The current laws providing for old-age pension were introduced in 1991 (social security), 1992 (superannuation guarantee), and in 1999 (the new system) (www.socialsecurity.gov). Social assistance covers all persons residing in Australia; superannuation or mandatory occupational pension covers all employed persons older than 17 years but younger than 70 years earning more than A$450 a month. The self-employed are excluded from the system. Funds for the superannuation system are sourced on a voluntary basis and is tax deductible up to a maximum of

A\$5,000 plus 75 per cent of a contribution in excess of this amount or the aged-based contribution (younger than 35, A\$15,260; aged 35 to 49, A\$42,385; aged 50 and above, A\$105,113) whichever is lower. There is no upper limit for voluntary contributions. The employer contributes 9 per cent of basic wages up to a maximum of A\$35,240 per quarter. The employer contributions are tax deductible up to a certain limit, depending on the age of employee. For employees younger than 35, the maximum annual tax deductible wage is A\$15,260; if aged 35 to 49, A\$42,385; or if aged 50 and above, A\$105,113. The government bears the total cost for social security benefit payments from current general revenue and matches the voluntary contributions made by the insured on the basis of A\$1.50 for each A\$1.00 contributed up to A\$1,500 per annum for low-income earners (www.socialsecurity.gov).

The occupational superannuation schemes are generally employer-sponsored pension plans. These programs were largely confined to white-collar government workers, employees of financial organisations, and workers in large manufacturing entitles. From the mid-1970s and throughout the 1980s Australia experienced a rapid growth of private coverage with pension schemes becoming more of an industrial issue (Schulz, 2005). Contributions to these schemes increased from 45 per cent in 1982 to around 70 per cent by the end of the decade, with nearly half of this growth from government employees, with the most common pension payout being lump-sum payments and government schemes that are annuity based (Schulz, 2005). The national wage case hearing in 1986 resulted in an increased superannuation coverage at the same time when it became compulsory that required savings accumulated in superannuation funds be both transferable and preserved until the age of 55 (Borowski, 2005).

In July 1992 superannuation guarantee (SG) funds took effect with all employers without pension plans for their employees required to pay a minimum of 3 per cent (expected to increase progressively up to a maximum of 9 per cent of an employee's salary into an individual superannuation account). The expected maximum was reached in 2002, with the result that about 90 per cent of Australian workers (almost all full-time and a quarter of part-time workers) are now covered by superannuation (Stanford, 2003). The introduction of the SG scheme in Australia is regarded as a victory for leaders in the labour party in terms of policies favouring an ideological shift towards reliance on market forces and the

liberalising of macro-economic management (Olsberg, 1997; Schulz, 2005). However, Bryan (2004) interprets this shift as being motivated by a lack of national saving to deal with the financial challenges of the ageing of the population. Thus, either government needed to increase its claim on national savings via taxation to fund a public pension scheme, or private saving for old-age has to be mandated to reduce the burden on the future welfare budget. The private saving choice prevailed and therefore, superannuation was introduced. However, there still seems to be considerable controversy regarding the nature and impact of the type of national saving (Bryan, 2004).

2.2.6 Japan

Old-age programs in Japan are of a social insurance type and managed through a PAYG system. It was first established in 1941 as an employees' pension insurance, with the relevant current laws dating from 1954 (employees' pension insurance) and 1959 (national pension) as amended in 1985. The system involves a flat-rate benefit for all residents under the national program and earnings-related benefits according to the employees' pension insurance program or other employment-related programs (www.socialsecurity.gov). The National pension program covers persons residing in Japan aged 20 to 59; voluntary coverage for persons residing in Japan aged 60 to 64 and for citizens residing abroad aged 20 to 64 (age 69 in special cases). Employees' pension insurance covers employees in industry and commerce, including seamen (partial contracting-out from employees' pension insurance is allowed if corporate plans provide for equivalent or higher benefits). The source of funds for employees' pension insurance is a contribution of 7.3 per cent (September 2006) of basic monthly earnings and a salary bonus before tax; miners and seamen contribute 7.9 per cent (September 2006) of basic monthly earnings including a salary bonus before tax from an insured person (www.socialsecurity.gov). The employer's contribution is 7.3 per cent (September 2006) of the monthly payroll including salary bonuses before tax. For the national pension program, government bears one-third of the total burden plus 25/1000 (increasing to one-half by the end of fiscal year 2009) of the cost of benefits and 100 per cent of administrative costs, financed by national tax. The total cost of administering employees' pension insurance is also financed through national taxes (www.socialsecurity.gov).

The Kosei-Nenkin-Hoken (KNH) is the principal program for private sector employees; while government employees, private school teachers and employees in agriculture/forestry/fishing organisations are covered by a special program provided by Kyosai-Kumial (mutual aid associations) with almost the same structure as the KNH system. The system operates two tiers: one pays flat-rate basic pension (Kiso Nenkin) benefits, applied to all residents (employees, unpaid families and self-employed). The other pays earnings-related benefits only to private and public employees with benefits indexed to inflation every year in terms of consumer prices and adjusted for wage growth every five years. An individual qualifies for the KNH flat-rate if he/she had reached the age of 65 years before 1999. However, if the individual had retired after that date he/she would get full benefits at age 60 (Oishi and Oshio, 2006). Japan has reformed its retirement programs in 2000 with the objective to lower contributions paid by future generations and making the benefits less generous than the 1994 reform (Oishi and Oshio, 2006).

2.2.7 Taiwan

In 1950 Taiwan introduced the first law on social insurance systems with a lump-sum benefit based on 36 times the last working month's salary (Hu, *et al*., 2000). The current laws were introduced in 1958 (labour insurance) and implemented in 1960, with amendments in 1988, 1994, 2000, 2001 and 2003.

The Taiwanese public employees' insurance programs and the labour insurance programs are financed by a PAYG system. This system is likely to cause serious problems to government finances in the near future given the rapid ageing of the population. It covers employees between ages 15 and 60 in firms in industry and commerce, mines and plantations with five or more workers; wage-earning public-sector employees; public-utility employees; fishermen and some self-employed persons in service occupations. Voluntary coverage applies to employees in firms with fewer than five workers, the self-employed (except for those in service occupations with compulsory coverage), employees older than age 60 working in covered employment and persons involuntarily unemployed

with 15 years of coverage. Special systems for civil servants, farmers, salaried public-sector employees and the staff of private schools exist.

The insured person contributes 1.1 per cent of gross monthly earnings with maximum monthly contributions at NT$43,900 (adjusted according to changes in minimum wage). The contributions for self-employed are set at 3.3 per cent of gross monthly income with maximum monthly earnings for contributions at NT$43,900 (adjusted according to changes in minimum wage). The employer contributes 3.8 per cent of its monthly payroll with the maximum monthly earnings for contributions at NT$43,900 (adjusted according to changes in minimum wage); while the government contributes 0.55 per cent of employee wages (self-employed 2.2 per cent of income) and the cost of administration, with maximum monthly earnings for contributions at NT$43,900 (adjusted according to changes in minimum wage) (www.socialsecurity.gov).

Hu, *et al.* (2000) indicate that the population of Taiwan is ageing at a more rapid rate than that of western nations. The authors cite the Council for Economic Planning and Development, 1999: Table 3 as their source of information which indicates that the share of the population aged 65 and above is projected to be 9.9 per cent by 2010 and 21 per cent by 2035. The dependence ratio is also projected to rise from 15.3 per cent in 1996 to 17.4 per cent in 2010 and 42.0 per cent by 2035 (Hu*, et al.*, 2000).

Contrary to this system, most social security systems in other Asian countries are partially or fully funded. An example of such a system in other Asian countries is that of Singapore with old-age pensions in that country fully funded through individual saving accounts and managed by a provident fund with the contribution to this provident fund set at 20 per cent of the worker's earning. At the retirement age of 65, a worker in Singapore is paid a lump-sum equal to the total employer and employee contributions, plus at least 5.5 per cent compound interest, less the amount of s$15,000 that is put aside for medical emergences (Hu, *et al.*, 2000).

The Taiwanese economy is dominated by small and medium enterprises with many self-employed workers. The majority of working in these entities is not covered by any type of social insurance available in the country (Hu, *et al.*, 2000). However, Hu, *et al.* also refer

to a proposed new social security system that would revise the public employees program and labour pension program and at the same time create a National Pension Program (similar to the Japanese system) to cover those not yet insured by either of the existing programs.

The new devised program is a defined-benefit program with all individuals receiving an identical flat monthly benefit that provides only for basic living expenses. The full benefit set to be 65 per cent of average consumption expenditure in the preceding two years; it also sets the minimum guaranteed benefit levels at NT$2,000 per month and all benefits are indexed to the consumer price index (Hu, *et al.*, 2000). This new system seems to be partially funded. However, the authors warn that the new system will have negative effects on aggregate saving due to the rapid ageing of the Taiwanese population because the negative saving effect will be relatively small in the first ten years but that it will increase after that. They also suggest that the funding ratio be increased to sustain growth and living standards.

2.2.8 Canada

The Canadian old-age security system (OAS) introduced in 1952, replacing the means-tested benefit system that had been in operation since 1927 and is managed at a provincial level. It is available to anyone aged 65 and above meeting the residence requirements. In 1995 the benefit payments from OAS pension in 1995 amounted to 19 per cent of the median monthly earnings of 20-64 year old males in Canada (www.socialsecurity.gov). Individuals not meeting the residence qualifying conditions receive entitlement for a partial OAS benefit and it has been indexed to the consumer price index since 1972. These benefits are fully taxable both by federal and provincial income taxes.

The largest component of the social security system in Canada is the Canada Pension Plan (CPP) and the Quebec Pension Plan (QPP). Both programs administered by Quebec and the rest of Canada were introduced in 1966 (Gruber, 1997). The source of funding for the plan is through a payroll tax of 2.7 per cent each on both employer and employees and levied up to the maximum pensionable earnings of the year (YMPE) (www.socialsecurity.gov). The YMPE is indexed to the growth in average wages in

Canada. The eligibility to the plan is conditioned on contributions for at least one calendar year during the contributory period from ages 18 to 65.

Before 1984 the QPP and before 1987 the CPP benefits could not be claimed before 65 years of age and no adjustment for delayed claims existed (Gruber, 1997; www.socialsecurity.gov). Since then individuals can claim benefit payments as early as age 60 with a reduction of 0.5 per cent per month for early claiming before the age of 65 and an increase of 0.5 per cent per month for delayed claiming after the age of 65 (Gruber, 1997; www.socialsecurity.gov). In 1975 the earning tests were eliminated and reintroduced in 1984 and 1987 with the introduction of early retirement, implying that workers can only claim benefits if their annual earnings do not exceed the maximum retirement pension payable at age 65 for the year in which the pension is claimed (Gruber, 1997). The benefits from CPP/QPP are indexed to the consumer price index and fully taxable by the federal and provincial income taxes (Gruber, 1997; www.socialsecurity.gov).

In addition to the above system there a means-tested guaranteed income supplement (GIS) was introduced in 1967 available to recipients of OAS, with the level for income means-testing defined in the same way than for income tax purposes. A means-tested spouse allowance (SPA) introduced in 1975 is also available on a monthly basis to 60-64 year old spouses of OAS recipients and to 60-64 year old widows/widowers (Gruber, 1997; www.socialsecurity.gov).

There are also a number of provincial programs that provide supplements to low income retirees and disability insurance (DI) programs that operate through the CPP and QPP systems. The DI program provides benefits to workers unable to work due to disability, where the basic benefits structure consists of two portions: a flat-rate portion paying a lump-sum to all disabled individuals and an earning-related portion paying 75 per cent of the applicable CPP and QPP, calculated with the contributory period ending at the date of disability. Gruber (1996) shows that although this program is fairly stringently screened, its structure of benefits has an important effect on labour supply.

Privately defined benefit pension plans are available to individual workers with the same incentive features as that for public insurance plans, called occupational pensions of RRPs. In 1992, 47.5 per cent of paid workers were covered by these systems, where 90 per cent of members were covered by defined benefit plans, with the share of defined contributions also growing slightly in most recent years (Gruber, 1997). Gruber argues that these defined contribution plans may affect retirement through the income effect only if no tax subsidy exists on the decision to work since payouts are not dependent on work patterns.

This section illustrated that there are important lesson to be learnt from retirement programs existing around the world:

(i)   All schemes allow contributions for both private and government managed funds,

(ii)   Since the early 1980s the majority of schemes have been adjusted continuously due to changes in demographic patterns that originate financial constraints to the government budget, in particular for developed countries,

(iii)   Private saving for retirement clearly not sufficient, in particular from the beginning of the 1980s, and

(iv)   The higher rates of unemployment, including informally employed (self-employed) of the labour force, the large is the government budget.

These features of social security programs around the world illustrate that these programs may have significant impact in the economy. Therefore, the following sections analyse, based on existing literature, the effects of social security on saving, growth in output and fertility.

2.3 Empirical Literature

A voluminous literature exists with regard to the impact of social security programs on the economies of many regions around the world. Unfortunately studies on African countries

and sub-Saharan African countries in particular are lacking, probably due to a shortage of statistical information or poor data recording. However, studies on other parts of the world, especially other developing countries such as Latin-American and Asian countries, could serve as useful references in an attempt to study retirement programs in sub-Saharan African countries. This section highlights some of the empirical work that has been done in the assessment of the impact of retirement programs in different economies. This is relevant to sub-Saharan African countries in view of their policies for poverty alleviation and sustainable economic growth. In particular this section analyses the empirical work regarding the impact of social security on saving, growth and fertility.

2.3.1 Social security and saving

Almost all the economists in the identified studies agree that social security programs, in one way or another, play an important role in boosting national saving. They do however, differ markedly in terms of the nature of the social security program that contributes to national saving. James (1998, 1996), the World Bank (1994), Feldstein (1998), Holzamann (1997, 2000) and many others believe that only pre-funding or defined contributions to privately managed social security programs are capable of contributing to national saving. Others like Orszig and Sitglitz (1999), Orszig (1999) and Barr (2000, 2002) believe that it is not pre-funding *per se* that contributes to national saving, but the regulation constraints imposed on pure pay-as-you-go systems. Should those legislative constraints be removed and the systems allowed to hold assets similar to those of pre-funding privately managed social security schemes, the effects of them, irrespective of being publicly or privately managed, would be indifferent. Others argue that the structure of the population plays a significant role in the national rates of saving (Disney, 1996; Masson, *et al.*, 1995).

Studies show that there is mixed evidence regarding the nature of retirement schemes that contribute to saving. At the individual level Davis and Hu (2004) argue that "*A strong effect of funding on personal saving appears a priori unlikely to hold*". The main argument is that there is a substitution effect between pre-funding (as part of household assets) and other forms of saving. However, the illiquidity of pension assets may imply that this

substitution effect does not occur on a one-to-one basis (Pesando, 1992). Also, in many instances the legislation on pension systems does not allow future pension benefits to be used in mortgaging (Cifuentes and Valdes-Prieto, 1997), which may induce individuals to save. The imperfection of capital markets and other liquidity constraints do not allow individuals to borrow freely in the markets, thereby compelling them to save (Hubbard, 1986).

Although it is a contentious concept, shifting from unfunded to pre-funded systems is thought to increase personal saving (World Bank, 1994; Feldstein, 1995). Because of the decreasing saving rates since the 1980s, tax incentives that increase returns on saving via pension funds, have been thought to have a positive effect on aggregate saving (McCarthy and Neuberger, 2004). Tests on US defined benefit funds indicate that personal saving has increased between 0.35-0.5 for every unit increase of pension fund assets (Pesando, 1992). Feldstein (1995) found an increase of 0.5 for the decrease in US social security wealth. Davis and Hu (2004) indicate that the cost of tax incentives to pension funds reduces the overall benefit of national savings by around 0.2. Edwards (1995) suggests that unfunded pay-as-you-go social security systems reduce private saving. Nhabinde and Schoeman (2005) estimated a reduction on personal saving of 0.33 per cent for South Africa. Rossi and Visco (1995) estimated a reduction in personal saving of 0.66 for Italy. Cigno, *et al.* (2003) found that public pension funds have positive effects on saving in a time-series data for a number of countries.

James (1996) argued that the main advantage of the World Bank multi-pillar model is that it increases national saving. But Davis and Hu (2004) argue that the effect on personal saving of the growth of pension funds could be offset at the national level by the fall in public saving. This is due to transition costs involved in the shift from publicly managed pension funds to privately managed ones, as well as the cost of the tax subsidies to personal saving and the guarantees that government offers in the course of the transition.

It is crucial how government finances the transition costs, as well as the cost of guarantees. Cesaratto (2003) argues that if government finances the implicit debt by borrowing, public saving would decrease and national saving would remain unchanged or even decrease depending on the response of private saving and on how much the public saving falls.

Unless the marginal propensity to consume retirement benefits is equal to one, the effects of retirement funds in the Barro (1974) model are unclear if government issues debt to finance social security. It follows that the reduction in individual resources may be more or less than the reduction in intertemporal consumption of individuals.

In their simulation Hviding and Merette (1998) found that debt financed transition costs may have no effect on national saving and output. Davis and Hu (2004) argue *ceteris paribus* that if the transition costs are partly financed by taxes; national saving is likely to increase as public saving would not decline significantly. In the long-run, however, transition costs financed by taxes are likely to cause a small increase in national saving (Cifuentes and Valdes-Prieto, 1997). According to Barro (1974), taxes raised to finance retirement programs will have no effect on saving, given the Ricardian equivalence.

According to the life cycle hypothesis models developed by Ando and Modigliani (1963), personal saving will be crowded-out when government finances retirement programs through taxes or debt. Kotlikoff (1979) estimates that "*in these models a 10 per cent tax rate of contribution to retirement funds reduces the steady state of capital stock by 20 per cent*", a phenomenon that may have serious implications for economic growth as discussed in the next section.

Although the impact of contributions to retirement schemes in the life cycle models has been accepted by most economists, there is disagreement with regard to the magnitude of the effects. Leimer and Lesnoy (1982) estimate the marginal propensity to consume social security wealth at 0.011 while Feldstein's (1974, 1995) estimates are 0.021 and 0.028, respectively. However, Leimer and Lesnoy's estimates were not statistically significant, while the Feldstein estimates were statistically significant. Interpreting these results, the Leimer and Lesnoy findings may imply that retirement funds have no effect on saving, while the Feldstein findings indicate that contributions to retirement schemes may significantly affect savings.

Schmidt-Hebbel (1999a) estimates that pension reforms in Chile contributed to an increase in the national saving rate regardless of how pension reforms were financed. He suggests that pension reforms can explain a rise in national saving of between 9.8 per cent and 45

per cent. Holzamann (1997) also suggests that aggregate savings in Chile increase with pension reform. In a panel data analysis Samwick (1999) finds that no countries except Chile, experienced an increase in gross national saving rates after implementing pension reforms towards non-PAYG systems. This conforms to what Orszig and Stiglitz (1999) and others have been arguing namely that it is not the shifting towards privately funded social security schemes that increases saving, but the removal of constraints imposed by legislation on PAYG holding assets, could produce similar results.

Furthermore, Samuelson (1975) argues that greater public thrift lowers the need for private thrift, "*and with uncertainty aside, the precise allocation between the two is a matter of indifference*". As he further argues, this perception implies that people tend to become myopic as paternalism becomes optimal, that is, individuals cannot see how private saving can "*offset what the mandatory system is doing to them*". These findings tend to favour the argument that retirement schemes crowd out private saving in life cycle models where bequest motives are non-operative, but at the same time they tend to favour the paternalistic intervention of government due to the myopic behaviour of individuals.

2.3.2 Social security and growth

Only a few empirical studies could be found on the effect of retirement funding on economic growth using panel data analysis. Zhang and Zhang (2004) quote Ehrlich and Zhong (1998) who studied a sample of 49 countries over 29 years as probably the only study published on this issue. Unfortunately there were no African countries among them. These studies found a positive relationship between retirement schemes and growth in a panel data analysis using a set of developing and developed countries. However, Ehrlich and Lui (1998) using a model where social security rates are treated econometrically as endogenous variables, showed that PAYG social security taxes have non-trivial effects on the long-run growth rate of the economy.

Davis and Hu (2004) also indicate that studies investigating the direct relationship between funded social security and growth are relatively sparse. Following Barr (2000) there are three steps (that do not necessarily hold) through which funded social security can induce economic growth: Firstly, pension reform leads to higher saving rates.

Secondly, the higher levels of saving are translated into more productive investment, and thirdly, investment results in increased output. On the other hand various authors argue that funding induces growth via improvement in market efficiency (Catalan, Impavido and Musalem, 2000; Schmidt-Hebbel, 1999a; Davis and Hu, 2004) and "incentives operating outside the saving-investment nexus" (Davis and Hu, 2004), like the growth in output in endogenous growth models.

Barro (1989) found that government transfers have a negative effect on fertility and saving but a positive effect on growth. In a study where he attempts to control for endogeneity of social security, Wigger (1999) found that retirement programs stimulate per capita growth and fertility for both developed and developing countries, but only if growth and fertility are primary policy concerns. Such effects increase investment in human capital without affecting saving rates, but growth does not cause changes in the rate of retirement benefits to income, a kind of "Aaron-condition". Schmidt-Hebbel (1999b) concluded that of 13 per cent private investment and average productivity of capital, pension reforms contributed between 0.4 to 1.5 per cent. Of 1.5 per cent of total factor productivity (TFP) it contributed by between 0.1 to 0.4 per cent. Hviding and Mérette (1998) in their simulation study of seven OECD countries, show that fundamental reforms have more impact than parametric reforms. While Avitabile (2003) shows that parametric reforms increase the probability of choosing to participate in the formal sector. He also indicates that in an economy where the informal sector is a considerable size, funding implies higher steady state levels of physical capital and the formal sector only works if the quality of legal enforcement is sufficiently high. Improving the quality of institutions is costly and time consuming, but necessary to ensure the satisfactory functioning of economic structures and social security institutions in particular.

Davis (2002) found an insignificant direct effect of institutional assets (including that of pension funds) on economic growth in 16 OECD countries. However, the size of the banking sector was found to be positively linked to economic growth. Using two models (World Bank and economic growth and pension fund assets and economic growth) Hu (2004) attempted to link pension reforms, growth of pension assets and economic growth for data from 59 countries directly. Hu's results showed that pension reforms are negatively related to TFP (Total Factor Productivity) and investment in the short-run but

positively in the long-run. Davis and Hu (2004), using data from 38 countries with a modified framework of a Cobb-Douglas production function, found co-integrating relationship between pension assets, capital stock and output, with pension funds positively related to output. These outcomes will be assessed for SSA countries, where economic growth and the protection of the elderly have to be addressed. The background of the degradation of informal social security systems has to be considered (due to migration in search of better living conditions)

2.3.3 Social security and fertility

After Barro (1974) and the following developments on the role of fertility on individual consumption-saving decisions[7], the development of retirement programs is one of the most important explanations for the declining rates of fertility in developed countries since the 1950s (Becker and Barro, 1989). They investigate the impact of fertility on investment in human capital. Ehrlich and Lui (1998) argue that fertility appears to be one of the three determinants of the economic growth path.

A study by Ehrlich and Kim (2005) indicates that with the decline in fertility rates, human capital investment per child rises, raising the expected productivity per worker. This confirms findings of Becker, Murphy and Tamura (1990), that suggest that society can save across generations either by having more children (implying increased fertility), greater investment in each child (which implies lowering the number of children or fertility rates), and by the long term accumulation of physical capital[8]. In more recent growth models, human capital is seen as endogenous rather than exogenous as considered in neoclassical models like the Ramsey (1928) and Solow (1956) optimal growth models. In models where fertility is endogenised; social security affects fertility negatively (Ehrlich and Kim, 2005 and Boldrin, De Nardi and Jones, 2005).

[7] Becker and Barro (1986) developed a utility model of a dynastic family where altruistic parents maximize their utility taking into account the utility of all their dynastic family. In this model fertility has an important impact on consumption-saving decisions of parents.
[8] See also Ehrlich and Lui, 1991. Intergenerational trade, Longevity, and Economic Growth. *Journal of Political Economy*, Vol. 99: 1029-1059.

Ehrlich and Lui (1998) showed that social security financed by a PAYG system adversely affects fertility, saving and investment in human capital, even if family social security is efficient. However, Becker and Barro (1988) indicate that for given levels of fertility, benefits from social security and the taxes needed to finance these benefits, have exact offsetting effects on the wealth of a representative dynastic family, as in the Barro (1974) model. They show that a constant increase in social security benefits tends to reduce fertility temporarily even when children do not support their elderly parents. Contrarily, Boldrin, De Nardi and Jones (2005) argue that fertility does not show a tendency to revert to its previous rates. They base their conclusion on a comparative analysis of data on fertility tendencies in the US and Europe.

In sub-Saharan Africa, fertility rates are still high and comparable to those in the US and Europe in the 1940s and toward the end of the 1950s. This suggests that SSA countries may very soon enter a transition phase from high to lower fertility rates as many individuals, even in rural areas, begin to understand the costs involved in rearing children and educating them. The resultant provision of social security during and after transition may be of crucial importance. The take-off phase of economic development that many SSA countries are currently in may also contribute to lower fertility rates, as in the Ehrlich and Lui (1998) analysis. The question whether fertility rates will return to their previous levels, depends on the level of steady state fertility rates[9]. If the actual fertility rate is above the steady state fertility rate, which by assumption is equal to the steady state of the growth rate of the economy, fertility will fall with the introduction of social security. If the actual fertility rate is below the steady state fertility rate, fertility will rise with the introduction of social security[10].

Similarly, generous social security accompanied by high levels of public debt, as is the case of the majority of SSA countries, may have adverse effects on fertility, saving (unless public saving increases more than the reduction of personal saving), investment in human

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[9] Fertility rates are considered as steady state when they are able to maintain a dynastic family and compatible with the steady state economic growth rates, independent of technological progress.

[10] This behaviour is related to the optimal levels of bequests that individuals are willing to leave to each of their children. This implies that the number of children an individual is willing to have is endogenous.

capital and economic growth. This may be the result of myopia of individuals and the literacy problem, which prevents this flow of information.

Boldrin, De Nardi and Jones (2005) found a negative relationship from 1997, between social security and fertility in a cross-sectional data analysis of 104 countries. This finding seems to be confirmed by data from 1994 to 2003 for the 14 SSA countries (Figure 3.1). The figure shows that social security and net fertility rates (measured here as gross fertility less mortality, which is equivalent to population growth) are negatively correlated, suggesting that social security reduces fertility. Therefore, as many studies have indicated (see for example Ehrlich and Lui, 1991 and 1998) low fertility rates may have a positive effect on investment in human capital. Even in the Becker and Barro (1986 and 1988) models, social security reduces fertility, though they consider it as a temporary phenomenon.

These results are similar to those found in a comparative study between the US and Europe by Boldrin, De Nardi and Jones (2005). Figure 3.1 shows that in 2003, the degree of correlation in SSA countries was higher than in 1994, supporting the finding of earlier studies, in that as social security matures, individuals tend to rely less on children for support.

Figure 5: Cross-section data analysis

Cross-Section Data Analysis on Fertility Rates versus Social Security Benefits for Year 2003
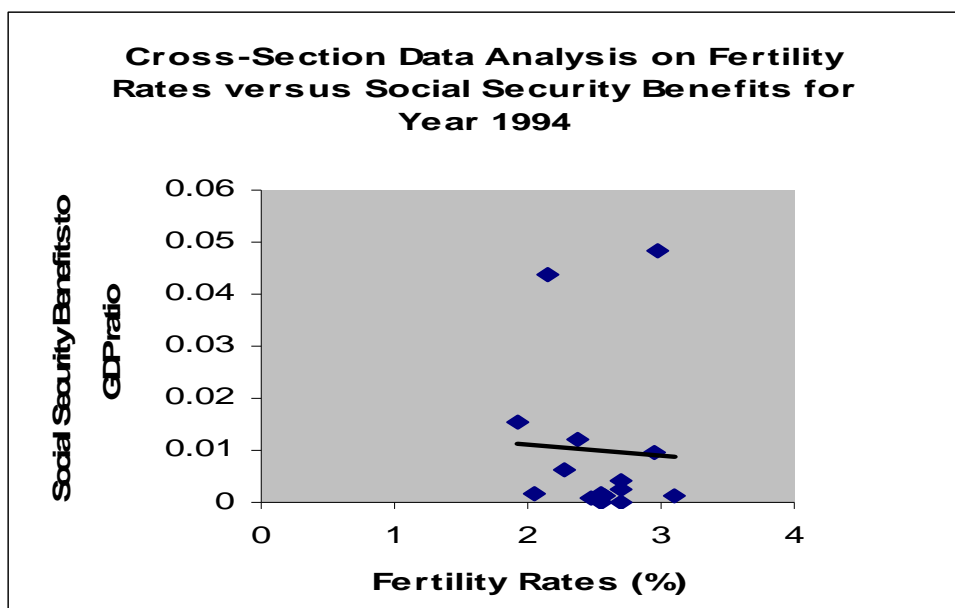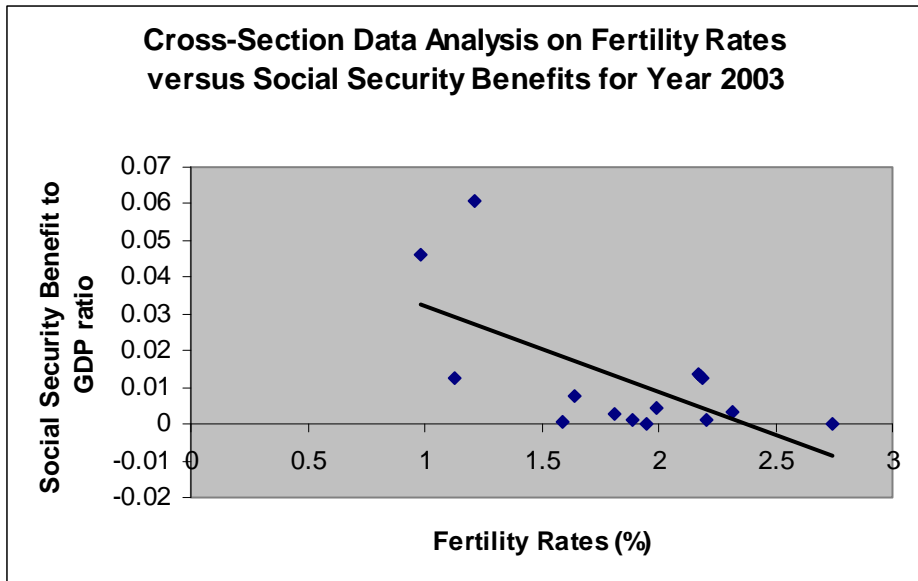
Both arguments are valid for African countries where individuals tend to have children for either motive. Another important fact is that parents derive emotional fulfilment from their children. Children therefore, do not only form an extension of their parents but also fulfil a part of their parents' happiness and this offers a certain kind of social security.

In addition, Boldrin, De Nardi and Jones (2005) argue that the degree of perfection of financial markets has important effects on fertility rates. They conclude that small increases in imperfection of financial markets could cause children to be a very valuable form of investment, in other words children act as a substitute for financial markets. This is evident in SSA countries where capital markets are poorly developed. Other forms of saving for retirement (as discussed in Chapter 3) have not yet been developed to take care of aged individuals (for example due to deficiencies in the regulatory framework and/or low rates of coverage). This means fertility rates in SSA countries may actually be compatible with the findings of Boldrin, De Nardi and Jones (2005). These elements of saving will determine the way different economies react to the effects of retirement systems.

2.4 Main Insights and Concluding Remarks

Chapter 2 analysed the literature on the impact of retirement programs on economic growth, saving and fertility. The chapter started off considering that the main rationale behind providing for retirement arose from the observation that many individuals suffer during retirement. In some countries like the US the provision of retirement programs originated from the need to compensate individuals who had suffered losses during the 1930s depression and World War II.

The empirical analysis of the available literature indicates that social security crowds-out saving if bequests are non-operative as in the modified life-cycle hypothesis models of Feldstein and his predecessors. However, in models where bequests are operative as the Barro (1974) model, social security has no effect on saving. The results of investigations that followed the World Bank Report (1994) show that there are no conclusive findings on the effects of social security on saving.

On the other hand, social security is seen as having a positive impact on economic growth and a number of studies have shown that reforming social security has positive effects on per capita growth rates (Schmidt-Hebbel, 1999b). However, some other authors argue that the effects of social security on per capita growth rates depend on whether the reforms are parametric or not (Avitabile, 2003). Overall there also does not seem to be agreement on the effects of social security on per capita growth rates of the economy. The results available in the literature show that some social security stimulates per capita growth (Wigger, 1999 and Barro, 1989), while others show that it depresses it (Zhong, 1998 and Ehrlich an Kim, 2005).

In another discussion on the effects of social security, the literature indicates that social security reduces fertility rates and contributes to investment in human capital. This is the only conclusive result in terms of the effects of social security on the performance of the economy and it components. Given the results discussed in literature, it is not clear how SSA countries will react, because of low per capita income and coverage rates, high transaction costs and most importantly the underdeveloped and unstable capital markets. High fertility rates in SSA countries may reflect these structural problems.

Chapter 3: The Nature, Problems and Potential of Social Security Programs in Sub-Saharan Africa

As indicated in Chapter 1, the concept of social security in this study is narrowly defined, to include only those retirement schemes where individuals make contributions to a public or private institution during their lifetime earnings, with the aim of providing for old age after retirement. This chapter analyses the nature and operation of such retirement schemes in sub-Saharan Africa and explores reforms that may be implemented or considered.

In developing countries in general and sub-Saharan African countries in particular, social security is of crucial importance given the high levels of unemployment that lead to an increasing proportion of the population living in poverty conditions, especially the aged. A particular challenge is the increasing impact of the growing number of people in the informal sector in these economies. Thus, devising a mechanism that provides retirement income to the majority of the aged population is of extreme importance, especially in the context of regional integration and at the most advanced level, continental integration (NEPAD).

Firstly, the regulatory framework is analysed. Secondly, the sources of funding and qualifying conditions for benefit payments are identified and thirdly, the replacement rates across-sub-Saharan African countries are analysed. Finally, the possibility of reforms to the existing retirement systems is discussed.

3.1 Regulatory Framework and Coverage

As referred to in Chapter 1 pension or retirement systems in many sub-Saharan African countries were devised during the colonial era, with the regulatory framework mostly reflecting the interests of expatriates and a minor group of the indigenous population loyal to the former. These systems prevailed for a long period even after the independence of these countries. Until recently, retirement systems were simply absent in many of these countries, for example in Zimbabwe, Botswana and Sierra-Leone, the first regulatory frameworks date from 1993, 1996 and 2001 respectively (www.socialsecurity.gov).

The earliest documented regulation on retirement systems in sub-Saharan Africa dates in Mauritius from 1951, followed by South Africa, 1956 (Sephton, 1990), Congo (Kinshasa) 1956 and Guinea, 1958 (www.socialsecurity.gov). The majority of the regulations were implemented during the early 1960s through 1970s (www.socialsecurity.gov). The common type of retirement system used in many countries is social insurance, which includes provision for disability, survivors and dependents. Only a few countries form the exception like South Africa, with pension and provident funds and Swaziland, Tanzania and Kenya with provident funds that also allow for disability, survivors and dependents. Some other countries have dual systems, which allow for contributory and non-contributory systems.

In all countries public servants have their own regulatory systems. This complex system of regulatory retirement framework (Annexure 1) complicates its supervision and increases administrative costs. A more elaborate and simplified system is required that reduces the public burden and allows for conscious and advantageous contributions to retirement schemes. This implies, for example, that civil servants may be allowed to contribute to schemes that offer better returns on their contributions compared to publicly administered schemes.

Problems with the regulatory framework also have implications regarding coverage. Many workers in sub-Saharan African countries are relegated to poverty after retirement because they did not contribute to retirement schemes. In some cases this happens because there was no regulation, and in other cases because the existing regulation only covers individuals working in the formal sector, especially civil servants and public (sometimes also large private) companies. In many of these countries regulation is required that covers the majority of the working population in order to address the lack of income during old age.

In addition, the regulation in many sub-Saharan African countries does not allow for cross-border benefit payments. SADC countries have jumped one step ahead with the SADC Social Charter signed by member states in 2003, which is meant to facilitate the intensive consultations among the social partners in the region. Among other objectives, the Charter is aimed at promoting the establishment and harmonisation of effective and

efficient social security systems with increased levels of participation of member states to improve the lives of the elderly. A broader coverage program for the aged is promoted with improved levels of coordination among member states and different retirement systems available offering more investment opportunities.

Coverage could be an important vehicle in reducing poverty levels in many African countries. However, SSA countries are still far from reaching significant coverage levels compared to those in other parts of the world. For example, Olivier (2005) quoting the 2003 report of the Ministry of Labour, Youth Development and Sport in Tanzania, indicated that social insurance schemes only covered 5.4 per cent of the labour force of 16 million people. He also added that "in many of the other African countries the picture is not much different".

Coverage has been one of the major issues in the debate of how to provide retirement programs around the world. Of special importance is also to address the growing informal sector and ways in which to provide income in old age of those involved in this sector. This is of crucial importance, especially for societies often featured by increasing social disintegration and instability. An example of a natural shock is the loss of power of community arrangements due to migration (the breaking of close-knit community) that provided security to the aged and those incapable of working over a long period.

An improved coverage scheme should assist individuals to reduce their vulnerability to such shocks, but the question is how to devise a scheme with ample coverage while at the same time avoiding moral hazard? This is one of the major constraints when evaluating the effectiveness of existing retirement programs in reducing poverty amongst the aged who may end up in a poverty trap simply because they did not save enough during their life-time earnings. Poor savings occur mainly due to two reasons namely: (i) lack of foresight or myopia and/or (ii) very low lifetime earnings that do not allow individuals to save for their old age. In the latter case, descendants of such an individual also run the risk of ending up in poverty, due to lack of proper education to be able to compete in the labour market.

This and the growing importance of the informal sector, as a refuge for the poor, require that governments investigate alternative systems. They should consider mandatory savings for both the formal and informal sectors that can cover the majority of the population. However, this does not necessarily imply the privatisation of the retirement industry as has been argued, but instead reforming the actual programs in a manner that satisfy the requirements of the aged, their dependants and most importantly, the economy as a whole.

Another constraint related to sufficient coverage stems from the low population density in many of these countries, which increases administrative and compliance costs and the costs related to receiving benefit payments by the aged. Tanzania's provident fund scheme attempted to avoid such costs by paying a lump sum to a retiree who decides to live in a village. However, this solution may not be efficient, since the probability is high that the individual may exhaust the lump sum long before death.

3.2 Funding Retirement Systems and Qualifying Conditions for Benefit Payments

The most common way of funding retirement systems is the PAYG system, where both employers and employees contribute to the fund. In some countries the costs of non-contributory retirement benefits for public servants is borne entirely by the government. In the latter case the government's budget is frequently under strain, which complicates the adjustment of retirement benefits to the cost of living, with the result that governments prefer to keep the benefit payments at lower levels.

In "*Averting the Old Age Crisis*", the World Bank indicated that the adjustment of retirement benefits to the cost of living is crucial for poverty alleviation amongst the aged and their dependants. In fact, an individual who contributes to a retirement fund in a country featured by higher rates of inflation may receive negative benefit payments when he/she retires. Low returns on these funds and consequently an eventual negative benefit payout may discourage the current and future working populations to contribute to retirement funds. High tax rates to mitigate the adverse effects, like those arising due to inflation, may also discourage the supply of labour, which further reduces the source of

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funding to pay for promised benefits. If this situation is accompanied by generous qualifying conditions to benefit payments, the supply of experienced labour may be reduced even further.

The average retirement age in sub-Saharan Africa is 55 years except for Mauritius, Nigeria, Sierra Leone, Ghana, Zimbabwe and Cameroon, where the retirement age is 60. In Sao Tome and Principe it is 62 years for men and 57 years for women while in South Africa, Botswana, Mozambique and in Congo (Kinshasa) it is 65 years (Congo, 60 for women). In the Seychelles it is 63 years and in Swaziland 50 years. In many countries individuals are required to have contributed at least 5 years (60 months) before qualifying for benefit payments.

In almost all SSA countries governments have direct or indirect (but influential) control of the funds. However, government control generally leads to mismanagement (World Bank, 1994 and James, 1996), which could result in inefficiency in the selection of investment portfolios and high administrative costs. For example, Cameroon, Togo and the Ivory Coast are reported to have pension expenditures equal to their total revenue (Barbone and Sanchez, 2000). These problems along with the poor replacement rates lead to dissatisfaction amongst the members of social security systems, which in turn results in evasion that may cause a further depletion of the revenue base for social security purpose.

Thus, generous qualifying conditions and excessive government intervention often hinder the potential economic effects of retirement programs such as effects on national saving. Generous qualifying conditions that allow for early retirement, for example, may reduce the supply of experienced labour, which affects labour productivity negatively and consequently results in lower growth rates of the economy. Often government intervention implies compulsive investment in government securities, like bonds, with low returns that may lead to negative returns, especially in the presence of high inflation. Negative real returns, low rates of contribution due to low wages and high levels of inflation may lead to lower benefit payments. All these constraints distort expectations not only of the older generation but also the younger one due to the intergenerational transfers relationship featured by social security programs. Nevertheless, investing in government securities may not be bad *per se* should these securities be indexed to inflation to ensure that

individuals do not lose out on the real value of their expected benefits from their contributions to retirement schemes.

Annexure 2 (column 2 to 4) shows the qualifying conditions and the source of funds for countries where information is available.

3.3 Replacement Rates in Sub-Saharan African Countries

In many developing countries and sub-Saharan African countries in particular, benefit payments are under pressure due to low replacement. Many countries do not provide for an adjustment in the cost of living which reduces the replacement rates even further in real terms. Thus, replacement rates are also an important indicator that influence decisions whether to contribute to retirement systems or not.

Poor benefit payments and sometimes even negative payouts, could lead to evasion, since individuals perceive their contributions to retirement systems as a tax rather than a price paid for services offered (James, 1996). In addition, some countries like South Africa impose taxes on retirement benefits, which reduce benefit payments even further. The actual observed replacement rates influence decisions on whether to contribute to retirement systems or to evade them. Low replacement rates and a lack of capacity to monitor the contributions may result in moral hazard and free rider behaviour, stemming from the fact that individuals are only concerned about getting the entitlement. They postpone the contributions to a later stage of their working lives, provided that the number of contributions meets the minimum qualifying conditions. However, the actual observed replacement rates may also affect the productivity by inducing individuals to retire early.

When reaching retirement age, some countries pay a lump sum given the specific qualifying conditions. Some others like South Africa pay a fixed lump sum while the balance is converted into an annuity fund. This is necessary to avoid the possibility that individuals consume the entire sum before they die.

Annexure 2 (column 5 and 6) shows, by approximation, different official (regulated or statutory) replacement rates. As seen from the table there are huge differences between the different regulatory frameworks in terms of replacement rates. It also shows that some countries take into account the adjustment to the cost of living while others do not.

In general countries do not allow for cross-border benefit payments. For example, if someone works in Nigeria he or she is only allowed to enjoy the retirement benefits with retirement in Nigeria and this individual would lose the entitlement if he/she decides to live abroad after retirement. Cross-border restrictions limit the possibility of diversifying an investment portfolio given the underdevelopment of capital markets in many sub-Saharan African countries. Lifting such restrictions by allowing savings through retirement funds to be used for the development of domestic capital markets and thereby also contributing to domestic economic growth (Orszag and Stiglitz, 1999) seems to be important. However, liberalising the capital market with some amounts of retirement funds being allowed to be invested abroad is also important, especially in the context of regional economic development blocks, like SADC, WAEMU, EAST AFRICA, etc. It would allow for risk diversification and to take advantage of higher rates of return in other countries in the region or elsewhere. This could improve the replacement rates, thereby improving the life of retired individuals. Obviously the interest of the contributors to such retirement funds has to be protected.

3.4 Why Reforming Retirement Systems?

Reforming retirement schemes from the traditional PAYG systems has been a matter of discussion all around the world, especially in Latin American and transition economies. In the US and other OECD (Organization for Economic Co-operation and Development) countries there is a debate on whether privatising social security programs will produce better incentives to the economy. Chile is seen as one of the most successful examples in the reform of social security programs. Various options for reforming social security programs from PAYG have been proposed and discussed. These options range from privatising the management of retirement funds to a multi-pillar system, where there is interaction between private and publicly managed schemes.

One of the reasons for reforming retirement systems is the fact that social security financed by PAYG, crowds-out other government expenditure and most importantly entails an implicit pension debt with implications to the economy depending on the way it is financed. Moreover, the existing literature considers that PAYG has devastating intergenerational transfer effects, especially when accompanied by significant demographic changes. In general, social security financed by a PAYG system has macroeconomic, microeconomic, and political effects.

On the macroeconomic side it is argued that a PAYG system constrains personal savings, rates of return are lower and the investment of public trust funds have no welfare implications. On the microeconomic side, PAYG creates negative incentives to the labour market, since it encourages early retirement and its administrative costs are also higher. From a political point of view it is argued that government inefficiency and corruption provide a motivation for moving away from publicly managed social security systems. Bailout politics affect publicly managed systems more than privately managed ones and the investment of public trust funds is always squandered and mismanaged (Orszig and Stiglitz, 1999 and Barr, 2002).

The reform of PAYG systems is seen as the only way to address the above problems in order to make social security programs more efficient and effective at both the individual level (benefits received during retirement) and government level (reduction in the fiscal burden). The benefits of reforming PAYG occur because private management tends to offer more incentives than public management does. The reform of PAYG implies its substitution with a system composed of three different pillars as proposed by the World Bank Report (1994), which evaluates the policy options based on their impact on the aged and the economy as a whole.

According to the World Bank recommendations the first pillar should be a publicly managed system aimed at addressing the problem of redistribution. This pillar is basically aimed at poverty alleviation. The second pillar is the implementation of privately managed schemes aimed at addressing the problem of consumption smoothing while the third pillar addresses the problem of extra consumption during retirement for those who will and can (this is basically private saving). The first two pillars are mandatory, while the third is

voluntary, which corresponds to private saving through other financial or capital instruments. The fact that publicly and privately managed pillars are mandatory raises the question how to monitor the management of the funds to ensure that managers do not incur higher expenses and become involved in risky investments? On the other hand, in the case of many countries with well established PAYG systems, reforming this system (totally or partially) involves transition costs of the dimension of the reform. However, since the implicit debt on pension is generally high, the transition costs involved, independent of whether the reform is total or partial, are also high. Such transition costs have been one of the major reasons for opposing reforms of the PAYG systems in many countries[11].

3.4.1 Macroeconomic effects

The issue whether privatising retirement programs (in part or total) increases national saving is contentious, as sub-Saharan African countries have limited capacity to mobilise and invest the proceeds of contributions. Furthermore, the majority of individuals in these countries do not have the capacity to save out of their after tax earnings. This suggests that a switch from the PAYG social security systems to privately administered systems may not alter national saving as envisaged, unless accompanied by increased levels of public saving. However, given the indebtedness of the majority of African countries, reforming PAYG from publicly managed to privately managed systems (as proposed) may increase the financial burden of government. This will result in increased tax pressure on individuals and companies or increased interest rates if government has to resort to borrowing to finance this expenditure.

Orszig and Stiglitz (1999) and Barr (2002) suggest that reforming PAYG systems could operate without switching to privately defined contribution plans, as long as the functions of the public funds are so defined as to address the management problems in the same way privately defined contribution plans do. The authors argue that pre-funding in a narrow sense need not imply pre-funding in the broader sense. In the African context it seems to

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[11] For discussion on this issue please, see Orzig, P. R. and Stiglitz, J. E. (1999) and Barr, N. (2002) and Diamond, P. (1996) and (1998).

be reasonable to reform the existing systems within the existing social security framework (related to pre-funding in the broader sense), that is, firstly create capacity within the existing PAYG systems. This is to avoid higher costs that may deter the performance of these economies. Although James (1998b) argues that transition costs do not decrease public saving, this can only occur if the additional costs of regulation are not accounted for. Such costs, as well as the transition and administrative costs, may hamper the growth of the sub-Saharan African economies by deviating resources from its most productive use.

It is argued that rates of return are higher under privately administered schemes than under PAYG systems. However, Orszig (1999) uses a simple example, borrowed from Breyer (1989) to show that this argument may not be true and that only the initial generation benefits from the introduction of either PAYG or privately defined contributions plans. The only way this would not happen, is if it were possible to start from a situation where there is no initial generation that receives benefits to which it did not contribute.

Higher rates of return referred to by the PAYG reformists do not take into account the necessary expenses to finance the transition and administrative costs. As Barr (2002) argues, a simple comparison of the nominal rate of return may be misleading policy guidance. Orszig and Stiglitz (1999) wrote:

> "… The higher rate of return would result regardless of whether the additional
> funding is routed through individual accounts or a public trust fund, as long as
> the trust fund were allowed to hold the same type of assets as individual
> accounts. It is the additional funding, not the individual accounts themselves,
> that is crucial to producing the higher rate of return".

Apart from transition costs, administrative costs in sub-Saharan African countries are high to the extent that shifting from a PAYG system to a privately defined contribution plan (individual accounts) may not improve the rate of returns. The argument is that most retirement schemes in this part of the world are featured by high implicit debt[12] with

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[12] This categorization is done in relation to the size of the economies of these countries. Some authors have claimed that the implicit debt in these countries is small, but this is only true if the referred debt is compared

strong government intervention. This is not only because of the nature of the PAYG system, but also because of the higher rate of default from the contribution side. Thus, a shift from the PAYG system (if any) still requires strong government intervention through regulation and monitoring, which requires financial and human resources that are not readily available. Since this intervention may increase the cost of shifting away from the PAYG system, it has to be considered when evaluating the trade-off between the rates of return of publicly and privately managed retirement funds. Therefore, the above argument advanced by Orszig and Stiglitz (1999) to allow publicly managed funds to hold assets similar to those held by individual accounts, seems to be suitable for sub-Saharan African countries.

In addition, risk and diversification of portfolio may raise other complications to the analysis in the African context. Given the level of development of sub-Saharan African countries, the way risk is managed and portfolio diversified, is crucial to the stability of retirement funds. With a PAYG system, risk can be spread across generations, which is important for poverty alleviation and appropriate for this stage of development. Diversification under PAYG can help to lessen the financial risk for any given individual.

Some economists like James (1998b), Feldstein (2005), Davis and Hu (2004) and others may argue that the disclosure of information, better management, proper regulation and institutions could contribute towards enhanced performance of individual accounts. Government regulation may impose restrictions on investments from individual accounts as in Chile (Holzmann, 1997), thus protecting such accounts from high risks involved with other investments. However, sub-Saharan African countries are affected by exogenous factors such as structural problems and weaknesses in government institutions; corruption, etc. that could hamper the expected improvement in the performance of social security systems after reforms.

Therefore, the argument is that diversification in sub-Saharan African countries could be done within public PAYG systems with more responsibility demanded from the managers

to developed countries. But compared to the size of their economies the debt is also high as in developed countries.

of such social security institutions. It has to be ensured that managers are not involved in risky investments with the expectation that government will back them up when losses may occur. Thus, governments will have to create strong institutions (required for future moves) that can enforce regulations and monitor the performance of retirement schemes. Within this environment diversification may be beneficial (Geanakoplos, Mitchell, and Zeldes, 1999). Allowing for investment abroad could shelter the domestic market from volatility of returns but may be detrimental to the development of a domestic capital market (Davis and Hu, 2004). Alternatively, if social returns of investing domestically are higher than private returns of investing aboard, investing in the international market may not be beneficial (Orzig and Stiglitz, 1999). However, where the national income is subject to volatility due to a worsening terms-of-trade, investing abroad may be a beneficial alternative (Davis and Hu, 2004).

3.4.2 Microeconomic effects

The common claim of supporters of individual accounts is that the traditionally defined benefits distort labour markets. Their point is that individual accounts link benefits received to contributions made and because of that, workers are likely to consider contributions to retirement funds as a tax under defined benefits rather than defined contributions (James, 1998b)[13]. The question is what induces workers to consider contributions to retirement funds as a tax under PAYG and not under individual accounts? There is no specific reason that justifies this argument, since it is a matter of allocation.

The opponents of the individual account proposal, like Barr (2000), argue that the design of a retirement scheme is crucial to measure its impact on the labour market. Therefore, for this group of analysts a key trade-off lies between redistribution and incentives. Redistribution typically creates labour distortions, independent of means used. Diamond

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[13] For more in this argument see: Feldstein, M. 1998. "Introduction," in Martin Feldstein, ed., *Privatizing Social Security* (University of Chicago Press: Chicago, 1998). Bok, J.T., Combs, A. L., Schieber, S. J., Vargas, F. A., and Weaver, C. L. 1997. "Restoring Security to Our Social Security Retirement Program," *Report of the 1994-1996 advisory Council on Social Security, Volume I: Findings and Recommendations* (Washington, DC, 1997); James, E. 1998a. "Pension Reform: An efficiency-Equity Tradeoff?" in Nancy Birdsall, Carol Graham, and Richard Sabot, eds., *Beyond Tradeoffs* (Brookings Institution Press: Washington, 1998).

(1998) argues that any redistribution will create some labour distortion, independent of location, defined benefit formula or any other form of retirement system.

In general, distortionary effects on the labour market may not only arise because of taxes raised to finance social security under a PAYG system. Shifting to individual accounts with taxes to finance the transition cost, for example, may have distortionary effects on the labour market. In fact, Corsetti and Schmidt-Hebbel (1997) reported from their simulation that "debt-financed transition [costs] to individual accounts *reduces* output by between 1 and 4 per cent in the long-run because of the distortions from higher income taxes necessary to finance the debt" and the reduction in output has a significant effect on the labour market. In the context of sub-Saharan African countries, low per capita income may constrain governments to raise taxes to finance debt due to transition costs. Furthermore, high rates of unemployment, reflected by the growth of the informal sector, do not favour such policies. Some economists argue that the growth of the informal sector is due to distortions in the labour market, but in the case of developing countries this claim needs to be substantiated. The formal sector in these countries is not capable of absorbing the existing labour force and the growth of the informal sector is continuous, which reflects structural problems in these developing economies.

Orszig and Stiglitz (1999) argues that most of the distortions reported in the labour market are due to the fact that most of the discussions only consider the supply side of the labour market, with the assumption of perfect competition. They correctly argue that in developing countries this assumption "seems inappropriate", suggesting that the focus on the supply side only may be misplaced. In fact, in developing countries featured by high unemployment, lack of skills, etc., the demand side of the labour market is likely to determine the final equilibrium in this market. Thus, taxes channelled to retirement funds are not the only the cause of labour market distortions, but part of it.

Another argument against the use of PAYG systems is that it provides more incentives for early retirement than individual accounts. However, the diminishing productivity due to rapid technological changes may be a cause for early retirement as a form of insurance against it. In addition it is also said that competition lowers administrative costs of privately defined contribution plans. However, microeconomic theory confirms that

competition only reduces the excess rents that a monopolist may enjoy. The costs to a firm remain unless a process of restructuring and restraining in the labour force takes place. Centralised retirement fund management that constrains choices with economies of scale may contribute to lower costs compared to decentralised ones. In a decentralised approach costs tend to be high because of costs additional to administration, like excessive advertisement costs, loss of economies of scale, competitive returns, etc. (James, 1998b).

Thus, the privatisation of retirement schemes in sub-Saharan African countries may not contribute to the lower cost of such retirement schemes. However, a competitive market with a proper structure of regulatory institutions is required that could regulate and monitor the conduct and practices of privately managed schemes that are not yet established. This entails additional costs related to the acquisition of the necessary expertise. Furthermore, low incomes and the weakness of the capital market may discourage the private sector to enter the market, thus, leaving government to take care of the management of retirement systems. In fact, the majority of studies proposing the privatisation of social seecurity, are based on realities far removed from the sub-Saharan situation.

3.4.3 Political effects

Barr (2002) states that PAYG and funding are treated "similarly in the face of the output shocks" and that "since future output is uncertain, all pension schemes face uncertainty". In the economies of sub-Saharan African countries shocks and uncertainty regarding output are caused by factors impacting on production (mostly traditional agriculture) and intensified by exogenous factors like wars, droughts, floods, etc. These in turn impact on expenditure priorities and thus the sustainability of social security programs. These phenomena may increase the risks of private schemes as opposed to public schemes, since the managers of privately managed systems may seek more political favours (Orszig and Stiglitz, 1999). These favours may increase the risk of corruption and mismanagement of funds channelled to those institutions managing the pension funds. Knowledge (by the private sector) of the weaknesses of public institutions with regard to monitoring will increase the volatility of retirement funds.

The failure of government to monitor the behaviour of privately managed retirement schemes raises concerns regarding the effectiveness of government institutions. Schneider and Enste (2000) in their empirical study found that is not the high taxes *per se* that increase the size of the informal sector but the ineffectiveness and discretionary application of the tax system and regulations by governments. This justifies the concerns about the role of corrupt governments in regulating and monitoring pension systems privately managed (Heller, 1998). On this Orszig and Stiglitz (1999) wrote: "*It is difficult to know why a government that is inefficient and corrupt in administering a public benefit system would be efficient and honest in regulating a private one*". Avitabile (2003) in his analysis on "*PAYG parametric reforms and labour in the informal sector*" finds that "*with perfect enforcement of social security rules both the contribution rate and the contributory share of pension benefit does not affect the allocation of work between the formal and informal sector in equilibrium*". These findings have important implications for the possible political effects of reforming retirement systems in the SSA context due to corruption, deficient legal institutions and low coverage rates of retirement systems (but also with lower population density that increases transaction costs)[14].

With imperfect government regulation and monitoring in sub-Saharan countries, bailout politics (as they frequently are) may negatively affect privately managed defined contribution plans more than purely PAYG schemes. Thus, reforming the current systems to multi-pillar systems, with the second pillar privately managed, some guarantees have to be offered (Rocha, Gutierrez, and Hinz, 1999), even when such guarantees are to be implicit (Diamond and Valdes-Prieto, 1994). Bailout politics in developing countries and SSA countries in particular are of significant concern due to their potential impact on the already adverse financial performances of these countries (Esterly, Islam, and Stiglitz, 1999).

Such adverse financial performance in SSA countries is also important when analysing the impact of the investment of public trust funds. The imperfection of financial markets in sub-Saharan African countries and their dependence on foreign capital may increase the volatility in this market. The usual claim that reforms are required because private

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[14] See section 3.2 in this chapter

managers make better investment choices than public funds managers, can only be valid for SSA countries if capital markets were minimally developed with a proper regulatory framework. But as argued previously, the imperfection of government regulation and monitoring may increase the risk of private management of the funds with the increased potential of corruption.

Therefore, in sub-Saharan African countries the political effects of reforms may have an important impact on the stability of retirement schemes. Furthermore, the presence of a group of interests may influence the course of reforms as happened in Argentina, Brazil and Uruguay (Kay, 2001). Given this background it seems reasonable to accept that in SSA countries, reforms should start within the PAYG systems through a management contract (introduction of a principal-agent problem[15]). Government regulation should allow for more flexibility in terms of the assets to be held in the portfolio of retirement funds. At the same time governments should set up and strengthen institutions and capital markets that would be able to accommodate the reforms.

Lower rates of coverage accompanied by low incomes and low population density rates that increase transaction costs, also constitute constraints to the private sector to enter into the market, even if the reforms are politically and socially supported. In this case it is recommended that retirement systems be publicly managed which would contribute to the maintenance of macroeconomic stability and capturing scale economies. It is unlikely that the shifting from PAYG to privately managed systems would be able to achieve this. Barr (2002) points out that political sustainability, which includes strength of political will and duration and depth of political support, are important ingredients for the success of any reforms. Therefore, any political consideration of PAYG reforms has to take into account these important ingredients.

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[15] The principal-agent problem arises when the principal (employer) has interests in the performance of a firm but appoints an agent (employee) to act on his behalf and the principal cannot fully control what the agent does (The MIT Dictionary of Modern Economics, 1992). In other words an agent is a person who is employed to do and act on behalf of another person called the principal; the modern principle is that contracts entered into by an agent are regarded as entered into by the principal, provided the contract is within the scope of the agent's authority (Dictionary of Economics, 1987). In this case the principal bears the risk of assigning the task to the agent. The principal-agent problem also raises the issue of adverse selection which is basically a problem of information asymmetry between the principal and the agent.

3.5 Alternatives for Retirement Finance

In Chapter 1 it was pointed out that individuals find it difficult or are not motivated to save for retirement because they depend on the fact that government intervenes to compel or motivate them to save for their old age. This section investigates the rationale of government encouraging saving for retirement, given the variety and sophistication of insurance instruments available today. To this end the section investigates how the problem of adverse selection due to information asymmetry, may affect the choice of retirement instruments. It especially analyses the substitution effects (partial or total), if any, between publicly and privately administered social security systems. Other forms of assets that are potentially eligible to the household portfolio are also considered.

3.5.1 Insurance products for retirement

From a theoretical point of view one would assume that the objective of the suppliers of retirement products is to maximise the social welfare of individual members. However, due to problems of adverse selection (arising because of asymmetric information) and moral hazard, individuals are not able to correctly predict and efficiently select the optimal policy from a set of policies offered by suppliers of retirement insurance suppliers. Moral hazard arises due to externality problems related to the management of retirement funds by insurance companies.

The question is to what extent privately managed social security schemes and/or provision of old age policies can substitute (partially or totally), if any, the current publicly managed schemes in developing countries? The answer to this question will largely be determined by the higher transaction costs, low per capita income and most importantly, the less developed and unstable capital markets in such countries.

The argument is that the substitution of publicly managed retirement funds by private ones reduces the burden of such retirement programs on the public sector (Ehrlich and Zhong,

1998). Kotlikoff (1987) using the formulae suggested in Kotlikoff (1979) indicates that the burden of social security in the United States in 1986, would have been $8 trillion, which was 30 times more than the tax revenue necessary to pay for retirement benefits and 4.5 times larger than the 1986 official stock of US debt. This is an illustration of the burden borne by governments in providing unfunded retirement schemes, which has become an increased function for the ageing population. This phenomenon is even worse for developing countries, usually plagued by natural disasters, civil wars, low levels of productivity, lack of skills, etc.

Thus, for developing countries, shifting from publicly managed retirement funds to privately managed ones and/or motivating individuals to buy insurance policies, by means of tax incentives for example, may not solve the problem of the public burden. On the contrary, it may even worsen the problem because of the guarantees that government may have to offer to encourage such a shift[16]. The probability of default in the management of retirement funds in developing countries may be high and, therefore, undermine the stability of the system. Retirees expect government to act as provider in the last resort in order to ensure that they are entitled to their retirement benefits to which they may have contributed during their careers. Furthermore, the problem of asymmetric information in these countries is far from being solved (in many cases due to the literacy problem), leading to an even more complicated adverse selection problem. One solution is to place these institutions under strong financial supervision, normally the responsibility of central banks. However, due to corruption in many African countries, such supervision may not be efficient.

Given its popularity, PAYG systems still seems to be the ideal option for providing retirement security in developing countries and SSA countries in particular. Higher transaction costs, low per capita income, less developed and unstable capital markets, higher probability of default (moral hazard), complicated adverse selection problems, etc. cause other systems to be less viable. Under this retirement system government can still incur debt and use it to pay for retirement benefits. This, however, does not mean that reforms of current retirement systems may not be undertaken or started, but that it should

be initiated with caution. For example, reform could start by liberalising the asset holding of actual PAYG systems, in other words, allowing these systems to keep assets similar to those of defined contributions plans as proposed by Orszag and Stiglitz (1999).

3.5.2 Real assets as a retirement alternative

In the Barro (1974) model where bequests are operative, individuals are motivated to save more in order to be able to bequeath a certain amount to their descendants. In this case retirement funds tend not to reduce other forms of savings. Individuals with an uncertain future due to imperfect capital markets, tend to save more in the form of real assets, like real estate, whose value increases with uncertainty and which also serves as bequest for the entire dynastic family. Thus, real assets are included in the individual retirement portfolio not only due to bequests but also as precautionary measure and the need to supplement the inadequate benefits received from social security during retirement.

In Feldstein's (1974) model where bequests are non-operative, an individual's saving is crowded out by the presence of retirement funds. This implies that few individuals buy real assets to bequeath or use as precautionary saving to supplement income during retirement.

These findings have different implications in the analysis of the effects of retirement programs on the economy. In the first case, where individuals have a strong sense of providing for the welfare of their children, capital accumulation tends to be proportional to the number of children (Zhang and Zhang, 2004, Ehrlich and Lui, 1998, and Ehrlich and Kim, 2005), which implies that the economy will continue growing at a steady state rate. While in the second case the economy departs from its steady state and the accumulation of real assets declines.

The composition of the retirement portfolio of an individual largely depends on how his/her assets are being taxed to the extent that portfolios of an individual may reflect the

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[16] See also Rocha, Gutierrez ,and Hinz (1999) and Diamond-Valdo-Prieto (1994) for the case of Chile

tax structure of a country. In addition, the composition of the portfolio also reflects the level of risk aversion of an individual. Moreover, the composition of an individual's retirement portfolio at any given point in time will reflect expectations with regard to retirement benefits and the actual equilibrium level of the economy. Thus, if the expected after-tax returns from real assets in the individual's portfolio exceed the expected benefits from retirement funds, the individual will tend to substitute (partially or totally) real assets for retirement saving. However, since many retirement programs are compulsory, such individual liberty is constrained (Friedman, 1962) reducing the accumulation of real assets. This implies that retirement programs reduce not only the supply of capital but also the accumulation of real assets independent of final destination. This problem may be more controversial in developing than in developed countries.

3.5.3 Financial assets as a retirement alternative

This section investigates the range of financial assets available that individuals may include in their retirement portfolios in order to supplement or substitute retirement saving.

Such financial assets may include long-term government bonds, firm equities and other forms of financial assets such as strong foreign currencies. Apart from long-term government bonds, many financial assets are highly volatile, especially due to inflation. Furthermore, assets invested in the stock exchange may even reduce the initial capital. This means that the problem of information asymmetry plays an important role in choosing an investment portfolio with financial assets as alternative or complementary to retirement programs.

The problem of asymmetric information and imperfection in capital markets is also an important reason for paternalistic government intervention in providing retirement programs. Investing in financial assets as a means of future income is also affected by real rates of return and taxes. Thus by comparing the expected after-tax return on financial assets and benefits expected from retirement funds will determine the share of financial assets to be held in the retirement portfolio of an individual.

Again these arguments are harder to sustain in the case of developing countries and SSA countries in particular, since as argued in previous chapters many of these countries have weak financial and capital markets. That is, individuals in these countries have fewer choices to complement or substitute retirement funds through these markets. Moreover, the problem of moral hazard exists, mostly due to the lack of adequate management of financial assets and corruption. Yet, the adverse selection problem is more complex to control in these markets, even under a tightened financial regulatory system.

Thus, given the relatively high proportion of the population living below the breadline with a relatively low income, government intervention seems to be justifiable. However, as the economy moves out of the low per capita income phase and capital markets evolve, reforms in retirement programs have to be initiated. In addition, information should be made readily available to economic agents, while managerial skills have to be improved. However, literacy will continue to be a real constraint in the case of the majority of people living in sub-Saharan African countries.

3.6 Sustainability of government finances in sub-Saharan countries

Debt sustainability is a topic that is widely debated by academics and politicians given the consensus that higher levels of debt constrain economic development as a result of the cost of debt servicing. Low economic growth rates since the early 1980s and the economic business cycles due to movements in macroeconomic variables and their components, for example the debt crisis of 1982, induced most developing countries, in particular sub-Saharan countries, to borrow in excess of their capacities to address the challenges for development in their economies. The sustainability of the debt is often measured in terms of the capacity that a country has to generate enough resources to service the debt contracted (UNCTAD, 1998, 2000).

Therefore, the level of the debt is sustainable only when it contributes to development process and not an obstacle to it. In other words, debt is only sustainable in the long-run if it is capable of increasing the earnings of foreign exchange above the level of domestic needs that allow the country to repay the debt (UNCTAD, 1998, 2000). This implies that

debt occurred should contribute to the increase of a country's exports to at least compensate for imports.

One of the most important categories of government expenditure is expenditure on social security programs. Social security programs absorb in between 4.5 per cent and 10.7 per cent of the GDP in developed countries (Weller, 2004) but much less (0.1 to 3.6 per cent GDP) in developing countries. The need for the sustainability of these programs induced many governments, mainly in developed countries since 1980s, to search for alternative methods of financing them. The reason for this was that social security programs at the time had exerted an immense pressure on the government finances and as a result fuelled the implicit deficits. Government deficits should be evaluated in terms of their effects on macroeconomic variables, such as inflation, interest rate, and output (Jacobs, *et al.* 2002).

Table 3.1: Concessional Debt/GDP ratio (percentage)

	1980	1987	1988	1989	1995	1996	1997	2001
Benin	10	30	30	58	61	58	59	59
Cameroon	13	12	11	15	53	45	43	45
Ethiopia		29	31	33	70	145	135	81
Ghana	18	33	32	36	62	62	58	88
Kenya	10	24	25	25	44	42	35	35
Lesotho	12	51	46	47	56	53	48	53
Mali	37	92	92	96	113	101	104	106
Mozambique		155	185	172	208	141	98	57
Nigeria	1	2	2	2	6	3	3	3
Senegal	14	42	41	38	50	50	53	57
South Africa*	32	34	33	36	50	49	49	45
Zambia	21	78	49	41	85	115	97	98
Zimbabwe	0.3	13	12	12	24	17	17	15
sub-Saharan Africa	**6**	**18**	**18**	**18**	**49**	**26**	**24**	**24**
Excluding South Africa	**8**	**27**	**28**	**29**	**49**	**42**	**43**	**39**
Excl. South Africa and Nigeria	**12**	**31**	**32**	**33**	**57**	**55**	**53**	**49**

Source: African Development Indicators (various issues)
* Data on South Africa is taken from Reserve Bank Quarterly Bulletin and it is based on total central government debt.

Table 3.1 illustrates that a country such as Mozambique had been heavily engaged in borrowing as from the mid-1980s and during the 1990s with the highest debt/GDP ratio in that county achieved at 208 per cent in 1995. Since then its ratios have been declining

significantly. There against countries like Kenya, Cameroon, South Africa, Zimbabwe[17] and Nigeria have been showing stable debt/GDP ratios. However, globally debt/GDP ratios have been increasing in the majority of SSA countries, raising the question of the sustainability of the debt.

Table 3.2: Government primary deficit/surplus as percentage of GDP

	75-84	85-89	90+	2003
Benin		-2.7	-0.9	-0.5
Cameroon	1.6	-3.9	0.4	3.6
Ethiopia	-5.7	-4.2	-4	-5.7
Ghana	-1.1	-1.2	-3.3	-4.4
Kenya	-3	0	5.7	-5.3
Lesotho			4.3	-1.4
Mali	-7.7	-3.7	-1.7	-5.3
Mozambique	-8.5	-7.1	-1.8	-1.4
Nigeria			5.2	-1.3
Senegal	-4.3	1.2	1.6	-0.2
South Africa*	-3.73	-8.34	-4.13	-2.5
Zambia		-1.3	3.2	-6.6
Zimbabwe	-3.2	-3.2	0.4	-0.4
sub-Saharan Africa			-10.2	
Excluding South Africa			-8.2	
Excl. South Africa and Nigeria		-9.3	-9.8	

Source: African Development Indicators (various issues). Data for 2003 are taken from IFM Country Report

Data on South Africa is taken from Reserve Bank Quarterly Bulletin and it is based on total central government debt.

* Data on South Africa is taken from Reserve Bank Quarterly Bulletin and it is based on total central government debt.

Table 3.2 shows the decline in primary deficit/GDP ratios (with some countries showing surpluses in the 1990s) in the majority of SSA countries since late the 1970s through the 1980s and 1990s. Mozambique reduced its primary deficit from 8.5 per cent in early 1980s to 1.4 per cent in 2003. However, countries such as, for example, Ethiopia, Ghana, Mali and others, are still struggling to reduce their deficits. Higher levels of primary deficits imply higher levels of indebtedness which can only be sustainable if it contributes to persistent long-run growth[18].

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[17] In most recent years, particularly since 2002, Zimbabwe has gone into a economic crisis which would cause its debt position to change dramatically.

[18] This section is meant to discuss the transmission mechanisms, but only to hint on the effects of government deficits and borrowing on retirement expenditure.

In SSA countries borrowing capacity has been increasing despite the international efforts to reduce their debt through debt reducing initiatives. The reason being that most African countries, except oil exporters and South Africa, together with low economic growth and some other exogenous factors have seen the price of their exports dropping dramatically, since the beginning of the 1970s. This constitutes an obstacle to these countries to generate enough resources that would enable them to repay their contracted debt. These facts raise the issue of how primary deficits run by governments in SSA countries are sustainable. Burger (2004) argues that if government decides to become sustainable by running a primary surplus, the unsustainability of its deficit will be shifted to other sectors. He poses the question what would happen if these other sectors decide to accumulate more assets to prevent the declining of their financial assets and he suggests that inflation will rise, real interest rate will decline and output be depressed with further erosion of the tax base.

The issue is what happens if SSA country governments decide to reform their social security programs to provide for better social security programs similar to those offered in developed and middle-income countries? Table 3.3 shows (based on information available in 2003) that such a reform will increase the primary deficit and, therefore, increasing the need for borrowing. But the fact that the majority of SSA countries have their primary deficits declining, while their debts are increasing, means that fundamental problems will have to be taken care of before any reform of social security programs are considered. The reason is that reforms in social security programs involve significant costs related to financing them.

Table 3.3 shows how primary deficits in these countries would evolve if reforms are undertaken in order to bring expenditure in social security programs up to the level of countries like OECD the (7.5 per cent of GDP), Mongolia (6.8 per cent of GDP) and Armenia (3.6 per cent of GDP). The results show that SSA countries would have to resort to additional debt in order to finance such expenditure, which may not be sustainable from a debt management and persistent long-run economic development point of view.

The figures show that some countries are in better position to initiate reforms to their social security programs, but that a limitation exists regarding the sustainability of current deficits. Thus, SSA countries should be evaluated on a country to country basis, taking into account the countries' specificities, for example export capacity, level of

indebtedness, expected growth of output and the development of financial market among other factors, including informal sector.

Table 3.3: Government primary deficit/surplus as percentage of GDP (simulation)

	OECD 1)	Mongolia 2)	Armenia 3)
Benin	-6.55147	-6.4002376	-5.7089109
Cameroon	-0.62857	-0.5219408	-0.0344784
Ethiopia	-7.43376	-7.2939417	-6.6547669
Ghana	-5.84527	-5.6438677	-4.7231627
Kenya	-4.80745	-4.5975391	-3.6379486
Lesotho	-5.23451	-4.9328411	-3.5537977
Mali	-6.28347	-6.1375	-5.4702103
Mozambique	-2.70743	-2.6069202	-2.1474638
Nigeria	-4.67376	-4.4052396	-3.1777061
Senegal	-5.52045	-5.3607183	-4.6305095
South Africa*			
Zambia	-15.7281	-15.511514	-14.521319
Zimbabwe	-2.60963	-2.4327435	-1.6240976

1) Based on the average of 7.5% government spending on retirement programs in OECD countries

2) Based on 6.8% government spending on retirement programs in Mongolia

3) Based on 3.6% government spending on retirement programs in Armenia

Note: to this level of spending is added 1.4% for the administration of the program and all calculations are base on 2003 information.

* Data on South Africa is taken from Reserve Bank Quarterly Bulletin and it is based on total central government debt.

In conclusion the fact that debt/GDP ratios have been increasing together with a decline in the deficit/GDP ratios reflects a structural problem in SSA countries. The increasing of debt/GDP ratios are because of interest payments and accumulated deficits of the previous generations, that constrain fiscal space to allow for more expenditure on socio-economic expenditures such as retirement programs. Also, the relative levels of the deficit/GDP ratios do not allow for such fiscal expansion given the current constraints. In order to create fiscal space for social security programs, a number of factors will have to be taken into account and in a country to country basis, such as export capacity, prospects of economic growth, the size of informal sector, the level of development of financial markets, among other factors that may affect the course of the reforms and prevent the accumulation of large government deficits.

3.7 Main Insights and Concluding Remarks

Chapter 2 analysed the nature, problems and potential of existing retirement programs in SSA countries. The main conclusion is that retirement programs (mainly of a social assistance nature) have been basically designed for civil servants and major public and sometimes private enterprises. The majority of these regulatory frameworks were implemented during the 1960s through 1970s, directed especially to expatriates and a minor group of indigenous people. The nature of these retirement systems does not allow for ample coverage and therefore excludes the majority of the population from formal retirement programs.

Furthermore, replacement rates are too low given the low standard of living in these countries and the way in which these retirement systems were designed does not allow for adjustment to the cost of living. The result is that the standard of living of the elderly has been declining. Because of the poor benefit payments and sometimes even negative payouts, individuals may perceive contributions to retirement systems as a tax rather than a price paid for services offered; with the result that evasion may occur. It is also concluded that due to macroeconomic effects (for example, effects on national saving and economic growth), microeconomic effects (e.g. on labour market) and political effects (bailout politics), reforms of retirement systems as proposed in the literature, including the 1994 World Bank Report, may not produce the expected results. This is due to the vulnerability of SSA countries to output shocks, other exogenous factors such as wars, natural disasters, etc.

Therefore, reforming the existing retirement systems requires firstly, the strengthening of the institutional arrangements for regulation and monitoring. Secondly, before liberalising the existing systems, the introduction of the principal-agent model of management within the existing publicly managed systems. Thirdly, allowing a minimum investment abroad benefiting from such investment opportunities, should the returns more than compensate for social returns of local investment opportunities. Fourthly, there are various alternative options to retirement systems, individuals can buy insurance policies, real estate and financial assets as a way to provide for retirement. Finally, as long as bailout politics and

the possibility of corruption and mismanagement continues to be a real concern, publicly managed defined benefit plans still seem to be the viable option for SSA countries.

Chapter 4: Theoretical Framework

Many studies have linked retirement funds to economic activity through its impact on saving, the labour market and the performance of the economy. Kotlikoff (1979, 1987) distinguishes the effects of saving for retirement programs in Keynesian and Barro models and the saving effects in the life cycle model. He argues that in the Keynesian model where individuals consume the same fraction (constant marginal propensity to consume) of disposable income, retirement programs have no saving effects in the case where transfers from young to old are being made, since it does not change aggregate consumption.

In Barro's (1974) model of intergenerational altruism[19], retirement funds are also predicted not to affect saving. In this model the altruistic motive passes through generations, with individuals alive at present acting as if they will live infinitely, connected by a chain of operative intergenerational transfers. By acting as if they will live indefinitely, these agents maximise their utility functions, taking into account the utility of future generations (or of an entire dynasty in the Becker and Barro, 1988 terminology). In other words they internalise the utility functions of all their descendants. The solution to this optimisation problem holds that the consumption of a member of generation i depends on bequests received from the older generation, the labour income it receives and the rate of return of assets. Consumption is not affected by the introduction of social security and saving is thus also not affected. Hence, in the Barro (1974) model, changes in social security of generation i are just offset by increased bequests[20].

The effects of social security on saving indicate that changes in economic activity can only be caused by changes in productivity. In particular, the Barro model assumes the golden rule of the Samuelson (1958) and Diamond (1965) models, where only factor rewards and population changes can alter the level of equilibrium output. Under all these conditions,

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[19] See also the model of a dynastic family Becker and Barro (1986 and 1988) or of a safe family insurance setup model of Ehrlich and Lui (1998).
[20] See also Chapter 2, section 2.2.3

the level of saving is equal to that required to maintain the level of capital-labour ratio compatible to the general equilibrium or steady state of the economy.

4.1 Financing and Managing Retirement Programs

Since retirement contributions accumulated[21] are not sufficient to finance the benefits promised to retirees, social security programs are mostly financed through taxes levied on the income of the current working population. Employers also contribute a significant share depending on the country's legislation[22]. The traditional PAYG system is financed in this way. In a model of balanced growth or golden rule, this represents an efficient method of intergenerational transfers of wealth. The present value of the individual's contributions (taxes), equals the net present value of benefits received. However, in practice the present value of an individual's contributions is less than the present value of an individual's benefits, implying that the economy is not growing at its steady state growth rate. Omitting other factors such as race, sex, number of children, marital status, etc. as in Bennett (1979), the relationship between taxes paid and benefits received can be written as:

$$\text{Present value of benefits} = \sum_{t=1}^{n} B(1+r)^{-t} > \text{present value of taxes} = \sum_{t=1}^{n} T(1+r)^{-t}$$

Where: B = benefits; T = taxes paid; r = interest rate and t is the number of years the individual contributes to social security after entering the labour market.

Given a production function with constant returns to scale, where inputs comprise labour and capital, if $r \phi n + F_l(K, L)$ the employee will receive lower returns than when the contributions were invested in alternative assets. In this case, n is the growth rate of the population and $F_l(.)$ is the labour productivity growth.

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[21] In practice in a pure pay-as-you-go system there is no real accumulation of contributions since contributions from the young generation (currently working individuals) are used to finance the benefits of the old generation (the currently retired individuals).
[22] See also Annexure 2 of Chapter 3 for legislation on the contributions to retirement funds.

Furthermore, the population grows at different rates during different stages of development. This causes the funds required to pay for benefits to be far less than the amount that is actually contributed, thus putting strain on the soundness of the PAYG system of financing retirement programs. When these programs are financed by an unfunded PAYG system, the trust fund can only pay a few months of benefits. In order to compensate for the balance required, current taxes are used to finance current benefits, which in the case of demographic changes, exerts pressure on government to search for alternative methods of financing the deficit in retirement expenditure.

By contrast, in a funded retirement system, each individual contributes an amount to a trust fund, which is "just sufficient to meet all its future insurance obligations arising from the past contributions of all currently living workers and retirees" (Kotlikoff, 1987). This method of financing retirement programs by providing workers with the monetary value of annuities and insurance benefits, equal to their contributions, is considered fairly based.

It was mentioned that the rate of return (r) on retirement funds' investment in a steady state economy should equal the sum of the population growth rate (n) plus the productivity growth rate $(F_l(K,L) = g)$:

$$r = n + g$$

Considering that individuals live in two periods, the first period being the working period (with younger people contributing to retirement funds as in Diamond, 1965) and the second when individuals retire (for simplicity of exposition the possibility that an individual can work part of his/her second period is ruled out)[23]. In period 1 a young person contributes a fraction τ of his/her earnings to social security and the benefits he/she receive as social security when retired at time t + 1 are given as:

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[23] For a model with individuals working part of his/her second period see, Hu (1979), vol. 69(3), where the in the second period an individual works a fraction $(1 - \alpha_{t+1})$ of the time and then retire. His/her net earnings in this period are: $(1 - \alpha_{t+1})(W_{t+1} - T_{t+1})$ with a pension of $\alpha_{t+1}P$.

$$B = \tau W_t (1+n)(1+g)$$

Where: $(1+n)$ is the increase in number of workers for each beneficiary in period 2 and $(1+g)$ is the increase in the earnings of each worker in period 2 relative to period 1.

Now consider that the amount channelled to social security (τW_t) is channelled to alternative savings, earning the steady state interest rate (r), then in period $t + 1$ the individual could have received $\tau W_t (1+r)$. By comparing the two rates of return one could state that if $r \phi\, n + F_l(K, L)$ the worker is worse off under social security, that is the substitution effects or opportunity cost between the two is high. In this analysis the factor rewards are ignored, which may alter the final results of the impact of social security programs. If $r\, \pi\, n + F_l(K, L)$, the introduction of unfunded social security can be a Pareto improvement. Thus, in this chain, all future generations benefit since there is an infinite number of participants, namely all future generations, as in Barro (1974) and Becker and Barro (1986 and 1988). However, if $r = n + F_l(K, L)$, Pareto improvement no longer exists.

The way in which retirement programs are financed, raises the problem of how they should be managed and who should provide such retirement schemes. According to Hagemejer (2000) the providers of retirement funds can be public or private institutions. These institutions can be classified as social security funds, central, state or local governments, autonomous and self-administered pension funds, insurance companies, mutual benefit societies, public and private employers and private welfare and assistance institutions. In this study the focus is on retirement funds, managed by public and private institutions. Since panel data econometric techniques are being used and different countries have different administrators of their retirement systems, a distinction is only made between public and private administered funds.

Based on available literature, the way in which retirement systems are being managed have implications for the performance of the economy and more fundamentally, on the behaviour of workers' consumption-saving decisions. In many countries, pension system

administrators are compelled by law to invest a certain percentage of retirement contributions in government bonds, in other words, a captive market based on the assumption that government acts as assuror. While government assets are less risky, it follows that other capital market assets are more risky[24]. However, there is a trade-off between investing in secure assets (such as government bonds, treasury bills and other lower risk assets) and more risky assets (stock market, firm's shares, etc.) since the latter allows individuals to enjoy higher returns on their contributions to retirement funds than the former. The decision by government to compel institutions managing social security funds to invest a significant portion of their members' contributions into government bonds and other assets with a lower market risk, could contribute to the prevention of moral hazard, which poses a threat to the stability of retirement schemes.

Thus, through regulation, government has the responsibility to ensure that workers' contributions are being managed in a fairly and safely. Along with a regulatory function, many governments also provide services, such as a means test, food stamps, health care, etc. to the elderly and disabled people.

4.2 The Effects of Retirement Funds in the Life Cycle Model

Since the overlapping generations model of Samuelson (1958) and the emergence of models of consumption in the life cycle of an individual by Modigliani and Brumberg (1954) and Ando and Modigliani (1963), many studies have been conducted to analyse the effects of these models on the real economy. The Ando and Modigliani (1963) model has served as a framework for many researchers in this field. These life cycle models predict that the introduction of retirement schemes reduces saving, since it reduces disposable income, given the fact that individuals tend to maintain their consumption patterns over their entire life span. Given the life cycle hypothesis predictions, it is possible to foresee that social security will have implications on the performance of the economy, if it is assumed to operate under neoclassical fundamentals.

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[24] Chapter 3, section 2.5 discusses the different saving alternatives for old age.

The common framework used in life cycle models is a simple world where individuals live in two periods. In the first period they work, pay taxes (assumed to be the contributions to social security only) and consume the net income of these taxes. In the second period, the individuals, when old, receive transfers (equivalent to taxes paid when young, plus returns) from the now young generation. The income received is consumed and for the sake of simplicity no bequests are considered.

It is assumed that social security returns are equal to the rate of interest if invested in alternative assets. This assumption requires that:

$$\int_0^R W_t \tau e^{-rt} dt = \int_R^D V_t e^{-rt} dt \qquad (1)$$

Where: W is the income the individual receives during his/her working age; τ is the tax rate for funding retirement; V is the benefit received when the individual is retired; r is the interest rate, t represents the time dimension, [0, R] is the duration of the working period interval and [R, D] the interval during which the individual receives benefits. The Figure 6 illustrates this model.

Figure 6: Life-cycle of an individual contributing to an old age security
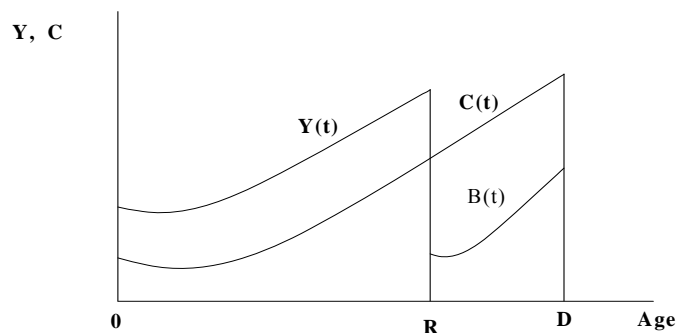
Where: C is consumption

Y is income

y(t) is the income of an individual during lifetime earnings, which is equivalent to W in the equation

c(t) is the entire lifetime consumption of an individual

B(t) is the benefits received during the retirement of an individual, which is equivalent to V in the equation

The utility and production functions in the neoclassical model are as follows:

Utility function➜ $U = C_1^\alpha C_2^\beta; \beta = 1 - \alpha$ (2)

Production function➜ $Y = K_t^\rho L_t^{1-\rho}$ (3)

Where: K is the capital stock of the economy, L is the labour force, C_1 and C_2 are consumption in periods 1 and 2, respectively, α, β, and ρ are the consumption and production elasticities, respectively.

The lifetime utility function (2) of the individual living in time t is a function of consumption in period 1 (when young) and period 2 (when old). Optimising the utility function, subject to a budget constraint:

$$C_1 + \frac{C_2}{1+r_2} = W_1(1-\tau_1) + \frac{V_2}{1+r_2}$$ (4)

yields the following consumption demand functions for the young individual:

$$C_1 = \beta[W_1(1-\tau_1) + \frac{V_2}{1+r_2}]$$ (5)

and the saving (supply of capital) of an individual of the young generation is:

$$S_2 = W_1(1 - \tau_1) - C_1 \tag{6}$$

alternatively this relationship can be expressed as:

$$S_2 = W_1(1 - \tau_1) - \beta[W_1(1 - \tau_1) + \frac{V_2}{1 + r_2}] \tag{6'}$$

if assumed that social security is financed by a PAYG system, the revenue per young individual is represented by:

$$V_1 = \tau_1 W_1 (1 + n) \tag{7}$$

Where: n is the population growth rate.

Given the revenue per young individual we can re-write (6') as:

$$S_2 = W_1(1 - \tau_1) - \beta[W_1(1 - \tau_1) + \frac{\tau_1 W_1(1 + n)}{1 + r_2}] \tag{8}$$

The optimisation problem (3) of a representative firm in the economy yields the usual demand for factors of the type:

$$W_1 = (1 - \gamma)k_1^\gamma \tag{9}$$

$$r_1 = \gamma k_1^{\gamma - 1} \tag{10}$$

The equilibrium condition in the capital market is given by:

$$K = \frac{S}{1 + n} \tag{11}$$

Combining the expressions above yields the general equilibrium changes in factor rewards, and thus the steady state of capital can be written as:

$$(1+n)k^* = w^*(1-\tau^*) - V[w^* - \frac{(r^*-n)\tau^* w^*}{1+r^*}]$$ (12)

This equation is comparable to the Samuelson (1975) equation:

$$(f(k) - rk) - C_1 = k(1+g)$$ (13)

Which corresponds to the level of saving of the young with a pool of savings from which, interest and principal are consumed by retired individuals. Substituting (9) into (12) and differentiating with respect to τ yields:

$$\frac{(1+n)\partial k^{1-\alpha}}{\partial \tau} = -(1-\alpha)V(1+\frac{n-\alpha k^{\alpha-1}}{1+\alpha k^{\alpha-1}})$$ (14)

This implies that the introduction of unfunded retirement schemes crowds out the steady state capital stock. Intuitively it implies that the benefits paid to start up retirees (first receivers) raises consumption by the same amount as the benefits paid. Assuming no distortions in the economy, the loss in the present value of benefits of the initial young generation as a result of the implementation of retirement schemes is $\frac{V(r-n)}{(1+r)}$ which is equivalent to a fraction of the reduction in consumption of the young generation. If assumed that the benefits paid $(V(1+n))$ are greater than the fractional reduction in the consumption of the young, total consumption in the initial period increases and saving is crowded out, leading to a new steady state with lower levels of saving.

In a general equilibrium situation, low levels of capital lead to a drop in wages, since the capital-labour ratio declines with increases in the interest rate. The latter benefits the older generation, while the present younger generation is worse off due to lower wages and investment is further crowded out due to the higher interest rate.

In this model social security affects the performance of the economy by constraining capital formation and interest rate increases, lowering the wages of the young generation

and thus reducing welfare. If generations are linked through a chain of intergenerational transfers, future generations will also be worse off, possibly resulting in a poverty trap.

4.3 Deficit Finance and Retirement Funds

The way the government deficit is financed is important to assess its effects on the capital market. If government has to borrow heavily it may crowd out investment, since such borrowing could result in increased interest rates. In models assuming that the provision of social security should only be funded by compulsory contributions, a lack of sufficient contributions can be explicitly considered as government debt policy (Kotlikoff, 1987). Thus, government borrows from the young to pay benefits to retired individuals, with the benefits exactly reflecting the principal (taxes paid when young) plus interest.

With government borrowing, the representative young generation can be portrayed as:

$$C_2 = S_1(1 + r_1) - T_1 \tag{15}$$

$$C_1 + \frac{C_2}{1 + r_2} = W_1 - \frac{T_2}{1 + r_2} \tag{16}$$

$$K_2 = \frac{(W_1 - C_1) - D_1}{1 + n} \tag{17}$$

$$T_1 = \tau_1 W_1 (1 + r_2) - \tau_2 W_2 (1 + n) \tag{18}$$

$$D_1 = \tau_1 W_1 \tag{19}$$

Where: D is the stock of official government debt to social security; T is the special tax levied on retirees and K_2 the funding per retiree.

The results show that financing retirement benefits through taxes or debt does not affect the economy differently; it reduces the supply of capital as can be seen from equation (17).

4.4 The Effects of Social Security on Fertility

The effects of social security on fertility and through this channel on saving and economic growth have been researched extensively theoretically and empirically. Unfortunately the results of the research are inconclusive because they are conflicting. This section explores the theoretical framework of the effects of social security on fertility in SSA countries based on the model from Boldrin, De Nardi and Jones (2005). This model initially assumes a PAYG system as is the case in most of the SSA countries, with agent i born in period t-1 maximising the following utility function:

$$U_{t-1} = u(c_t^m) + \varsigma u(c_t^o) + \beta u(C_{t+1}^o) \tag{20}$$

Subject to the following constraints:

$$d_t^i + s_t + c_t^m + a_t n_t \leq (1 - \tau_t)\omega_t(1 - b_t n_t) \tag{21}$$

$$c_t^o \leq d_t^i + \sum_{j \neq i, j=1}^{j=n_{t-1}} d_t^j + (1 - \xi)R_t x_t + T_t^o \tag{22}$$

$$c_{t+1}^o \leq \sum_{j=1}^{j=n_t} d_{t+1}^j + (1 - \xi)R_{t+1}x_{t+1} + T_{t+1}^o \tag{23}$$

$$x_{t+1} \leq \xi R_t x_t / n_{t-1} + s_t \tag{24}$$

where: T_t^o is the benefit payment to retirees; τ_t is the social security tax rate; c_t^m is the consumption of the labour force (middle-aged person in the author's terminology) in period t; c_t^o is the consumption of a retiree; s_t are the savings; n_t is the number of children; d_t^i is the level of support the agent i gives to his/her parents; x_t is the amount of capital stock each retiree controls in period t; w_t is the wage rate; R_t is the gross return on capital in period t. If it is assumed that the retirement benefit T_t^o received when retired,

equals the funding thereof, and if taxes levied are: $(1-\tau_t)w_t(1-b_tn_t)$; then $T_t^o = n_{t-1}\tau_t w_t(1-b_tn_t)$ and rewriting the budget constraint (21) we obtain:

$$d_t^i + s_t + c_t^m + \theta_t(\tau)n_t \leq (1-\tau_t)w_t \qquad (25)$$

The argument behind equilibrium equations (20-24) is that a representative agent *i* chooses the level of donation *d* to his parents so as to maximise his utility function (20). In the safe family social insurance setup (with no default) as in Ehrlich and Lui (1998), the optimisation problem implies that the elderly receive optimal transfers for consumption from their offspring. In this environment the introduction of social security will affect the choice of the number of children (*n*) and saving (*s*). The need for support from children decreases with improved social security, thereby reducing the level of donations required. But this reduction will depend on the level of compensation parents expect to receive from their children.

If social security benefits grow faster than the level of donation (*d*) received from children, parents will tend to reduce the number of children and increase investment in them, since the level of compensation or donation expected from children to parents may be correlated to the level of human capital accumulated. This reflects the choice regarding the number of children and quality referred to in the Ehrlich and Lui (1998) model, which implies that parents become more concerned about the quality of their children's education. In this model the level of support (compensation or donation) is related to the level of investment in human capital. A higher social security tax rate will initially increase the rate of return on the number of children relative to investment in human capital, because the added tax burden increases the ratio of emotional benefits relative to material compensation or donation from the children.

In SSA countries where families are still strongly connected by dynastic family structures as in Becker and Barro (1988), also known as the safe family insurance setup with no default as in Ehrlich and Lui (1998), social security may also negatively affect fertility, inducing parents to pay more attention to the quality of life rather than the number of their children.

However, the quality of education, lack of job opportunities, poverty and many other exogenous factors may constrain the performance of social security programs in these countries. This means that fertility rates fall much slower than in other regions in the world as parents still rely heavily on children as an important source of provision during retirement. Furthermore, the weaknesses of and highly imperfect financial markets[25] also hinder access to financial services to many African families, most of them living in rural areas. Boldrin, De Nardi and Jones (2005) argue that the development of financial markets reduces the value of within-family support during old age and, therefore, causes a decrease in fertility rates. As seen in many empirical studies (see the discussion in section 2.2.3) a negative relationship is expected between social security and fertility. However, the relationship is not as strong as in some other regions in the world because the weak financial markets would induce parents to choose other forms of retirement.

In many sub-Saharan African countries, children form part of the production function of a dynastic family or safe family insurance structure. They assist in breeding animals (mainly looked after by young boys) and crop farming and many other home tasks (predominantly the young girls). Even if parents are concerned about the education of their children, the great distances between schools and homes is a real constraint to the quality of children's education.

4.5 The Labour Market and Retirement Funds

Besides reducing the formation of capital as a result of rising interest rates, retirement funds also affect labour markets through income and substitution effects. The income effect is due to the fact that individuals expect windfall benefits that motivate them to retire early (interpreted as if their budget constraints have moved to a higher level). Payroll taxes induce the substitution effect between leisure and consumption and in some countries, means tested payments also lead to increased enjoyment of leisure. In fact, retirement programs may, to some extent, reduce the supply of labour not only of the elderly, but also of younger people who may choose to retire early. Boskin and Hurd

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[25] See also section 3.5.3 in Chapter 3.

(1984) found such evidence in the United State. The reduction of the supply of labour of experienced individuals leads to economic inefficiency, lower productivity and increased costs due to the recruitment of new labour and their training.

Kotlikoff (1987) stresses that the linkages between tax payments and benefits received, and the way in which workers perceive these linkages, plays an important role in assessing the impact of such an increase in effective labour taxes. He further argues that even if the perception was correct, there would still be a considerable labour supply distortion.

These results suggest that economies are potentially exposed to a degree of voluntary unemployment, since individuals may choose to retire early. If this is the case the capital-labour ratio will rise freeing up capital. Wages will also rise, thereby increasing the opportunity cost of leisure and thus, eventually influencing the individual to choose work rather than retirement, depending, of course, on the utility derived from enjoying leisure. At the same time the rise in the capital-labour ratio (freeing up of capital) reduces the interest rate, which implies increased levels of investment. The final equilibrium of the economy will depend on the adjustment process back to the steady state equilibrium of the capital-labour ratio.

4.6 Main Insights and Concluding Remarks

This chapter investigated the theoretical effects of social security on economic variables. It argues that the way in which retirement programs are being managed has implications for the performance of the economy and fundamentally on the behaviour of workers' consumption-saving decisions. In this regard, social security financed through debt or taxes in the life cycle model will crowd-out the supply of capital. The final point of equilibrium of the economy will thus depend on the response of economic fundamentals, for example, the extent to which future generations will be affected by success of saving of the current generation.

The chapter also investigated the extent to which the size of donation or compensation depends on the amount of investment parents are prepared to make to the quality life of

their children. The main conclusion is that the size of the donation correlates to the amount of investment parents are prepared to make on their children. However, the distances between school and homes may contribute to the poor quality education of children in many SSA countries; even when parents are concerned with the education of their children. In this process the final equilibrium of the economy will depend on the adjustment process back to the steady state equilibrium of the capital-labour ratio.

Chapter 5: Methodology

In the previous chapter, the theoretical linkages between retirement programs and the economy were outlined. In this chapter models are structured to test the impact of retirement funds on saving, economic growth and fertility in SSA countries.

5.1 Model Specifications

This section discusses the specifications of the models in a panel data form. Three models are specified, namely: (i) a savings model for the testing of the effects of retirement benefits on savings in SSA countries; (ii) a growth model for the testing of the effects of retirement benefits on growth in these economies and (iii) a fertility model to test for the effect of retirement benefits on fertility rates in SSA countries.

5.1.1 Model specification for saving

Recent studies like the Health and Retirement Study (HRS) (Gustman and Steinmeier, 1998) using survey data to study the effects of social security within a certain cohort group, used a variant of the Ando and Modigliani (1963) model. Other studies used the basic Ando and Modigliani model extended by Feldstein (1974) and some modified versions of the latter, for example the Barro (1978) specification. However, few studies have been conducted using a cross-country panel data analysis to test for the effects of social security on saving for developing countries (to the best of my knowledge, to date none have been done for sub-Saharan African countries).

Recognising the advantages of panel data analysis when comparing the effects of social security programs in the different sub-Saharan African countries with only limited data available, a bootstrapping regression fixed effects model will be applied to the Ehrlich and Kim (2005) model for saving:

$$Rinv_{it} = \beta_{1it}RBen_{it} + \beta_{21it}RGC_{it} + \beta_{3it}GPC_{it} + \beta_{4it}RDef_{it} + \beta_{5it}RNX_{it} + u_{it} \qquad (1)$$

Where: ➔ $u_{it} = \mu_i + \varepsilon_{it}$ is the error term component, with vectors of country specific fixed effects (μ_i) error component and ε_{it} the usual white noise error. The subscript i indicates country and t indicates a time dimension.

> RBen is the social security to GDP ratio
>
> RGC is the government consumption to GDP ratio
>
> GPC is the per capita economic growth rate
>
> RDef is the government surplus/deficit to GDP ratio
>
> RNX is the net exports to GDP ratio
>
> Rinv is the investment to GDP ratio
>
> β is the vector of the coefficients; $\beta_1 < 0$, $\beta_2 < 0$, $\beta_3 > 0$, $\beta_4 < 0$, and $\beta_5 > 0$

The investment to GDP ratio is used as a proxy for saving in country i. This specification is a version of the life cycle hypothesis and is based on national identity. This model will test the hypothesis that retirement funds reduce national saving in the sub-Saharan African countries.

5.1.2 Model specification for growth

It has been emphasised that retirement funds affect the growth of economies in a number of ways: firstly, by reducing the supply of capital, either through a reduction in private savings or through higher interest rates if financed by borrowing. Secondly, they stimulate the substitution effects between consumption and leisure, that is, they affect labour supply. Thirdly, they reduce fertility if parents are concerned with the education of their children (Zhang and Zhang, 2004 and Ehrlich and Kim, 2005). In the most recent growth models, human capital is seen as endogenous rather than exogenous as considered in neoclassical models, like the Ramsey (1928) and Solow (1956) optimal growth models. From the endogenous perspective, the assumption about investment in human capital is pro-growth.

For this reason, this section investigates to what extent retirement funds may influence the economic growth rates of some selected sub-Saharan African countries as stated in the following specification:

$$GPC_{it} = \beta_{1it}SEC_{it} + \beta_{2it}RGC_{it} + \beta_{3it}RBen_{it} + \beta_{4it}INFL_{it} + \beta_{5it}Open_{it} + u_{it} \qquad (2)$$

Where: ➔ $u_{it} = \mu_i + \varepsilon_{it}$ is the error term component, with vectors of country specific fixed effects (μ_i) error component and ε_{it} is the usual white noise error. The subscripts i and t are as defined before.

    GPC, RGC, RBen, and u_{it} have been defined previously

    SEC is secondary education attainment

    INFL is the inflation rate

    Open is openness of country i, defined as exports plus imports divided by GDP

    β is a vector of coefficients as explained earlier; $\beta_1>0$, $\beta_2<0$, and $\beta_3>0$

This model seeks to test the hypothesis that retirement funds are positively related to economic growth as in Zhang and Zhang (2004), Wigger (1999) and Ehrlich and Kim (2005). It is expected that the coefficient of the retirement benefit to GDP ratio would be positive as in the above studies.

5.1.3 Model specification for fertility

While retirement funds have shown adverse effects on the growth rates of economies, a number of studies seem to indicate consistent empirical results in relation to fertility (see Zhang and Zhang, 2004 and Ehrlich and Kim, 2005)[26]. The results of studies on the effects of retirement programs on fertility are consistently that it reduces fertility per woman and, therefore, increases investment in human capital per child[27]. Thus, two different model specifications from Zhang and Zhang (2004) and Ehrlich and Kim (2005) were combined to get the specification below. This specification allows the investigation of the effects of social security on fertility rates in sub-Saharan Africa, by applying a fixed effect one way error component model:

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[26] See also Chapter 2, section 2.2.3

[27] In the case of many dynastic families in SSA countries the expected reduction of fertility may not increase investment in human capital (at least in the initial phase of growth of social security programs) because of low income per capita that tend to slow down the reduction of fertility rates.

$$F_{it} = \beta_{1it} RBen_{jt} + \beta_{2it} RGC_{it} + \beta_{3it} GPC_{it} + \beta_{4it} open_{it} + u_{it} \qquad (3)$$

Where: ➤ $u_{it} = \mu_i + \varepsilon_{it}$ is the error term component, with vectors of country specific fixed effects (μ_i) error component and ε_{it} the usual white noise error.

        F is the fertility rate and all other variables have been specified earlier.

        β is the vector of the coefficients as explained earlier; $\beta_1<0$, $\beta_2>0$, $\beta_3<0$, and $\beta_4>0$

        Other variables are specified as before

In this model the hypothesis to be tested is: paid retirement benefits, reduce fertility rates in SSA countries. The outcome of the model will be viewed against the background of the evaluation of the reforms in social security programs as proposed by the World Bank Report (1994).

5.2 Data

This study comprises fourteen sub-Saharan African countries for whom consistent data on retirement benefit payments for at least ten years, were available.

The World Bank development indicators provide a comprehensive data on countries' investment and government consumption, surplus/deficit and net exports as a share of GDP, growth rates, etc. However, given the fact that no significant number of observations on fertility rates in many (all) sub-Saharan African countries exists, population growth is used as a proxy of net fertility, calculated as the gross fertility rate minus the mortality rate. Other sources of data, such as country statistics of the IMF were used to complement the required statistical information.

The data obtained from the World Bank CD-R statistics are in US dollars, but the majority of the country specific data of the IMF are in the various countries' currencies. However, this does not constitute a problem since only ratios are used, thereby avoiding discrepancies resulting from using data in their levels. It should be stated though that

research is not aimed at filling data gaps, but rather that the effect of social security on the performance of the SSA economies is measured using existing data whatever its quality.

5.3 Econometric Technique

The technique used in this study is based on the application of panel data analysis techniques. The advantage of using panel data analysis is that it allows for the quantification of the dynamics of adjustment as found in Baltagi (2001):

(i)   Panel data gives the ability to control for heterogeneity between countries of different characteristics and history.

(ii)   It allows for less collinearity among the variables, more degrees of freedom and more efficiency than time-series.

(iii)   It enables one to identify and measure the effects that are not detectable in pure time-series or cross-section data.

(iv)   It allows for the constructing and testing of more complicated behavioural models than pure cross-section or pure time-series.

It, therefore, applies a one-way error component model where the vector of country specific fixed effects (μ_i) of the error is unobservable but estimable. This technique allows for the control of unobservable country specific factors that may affect the economies of these countries but which are not captured by the variables in the model, thus allowing to control for the heterogeneity of the countries included in the study.

By controlling for all these factors, it is possible to identify policy influences that affect countries in a similar way. A test to check for countries' poolability is performed to evaluate the possibility of generalisability of the parameters estimated in the behavioural equation. Country's poolability means that the set of factors affecting one country may be similar to those affecting other countries because they are assumed to be defined by the

same parameters. Therefore, within the use of Least Square Dummy Variable (LSDV) fixed effects seem to be appropriate for this study.

Moreover, this study also considers the observation made by Mooney and Duval (1993) that the traditional parametric inference based on coefficients in a regression model relies on distributional conditions and assumptions that may not hold true for a given set of data. This constraint may result in biased estimates used to make inferences about the true population coefficient. Taking this into consideration the bootstrapping technique based on the Monte Carlo[28] sampling has been widely used in recent empirical studies. In this way a probability density function (PDF) known as an empirical probability distribution (EPD), can be constructed, which describes the distribution of coefficient of the true population.

Thus, bootstrapping being a non-parametric technique offers an important advantage to traditional probability density functions. It constructs an accurate distribution density function based on the data on hand by evoking a sufficiently large number of replications (re-sampling) with replacement, which in turn allows it to approximate the distribution of estimators.

Although panel data analysis as described above has important advantages, it is not without limitations and the two most important ones for this study are the short time-series dimension and the distortion of the measurements, which may increase computational difficulties.

5.4 Bootstrapping Steps

Bootstrapping in this study is based on random components of the panel regression models specified in sections 5.1.1, 5.1.2 and 5.1.3. These random components are the unrestricted

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[28] For Monte Carlo evidence on numerical performance of bootstrapping based tests see: Horowitz, J.L. (1995) and specifically on Wald test (used here) see: Gregory and veall (1985), Lafontaine and White (1986) and others for the discussion.

residuals from the error component $u_{it} = \mu_i + \varepsilon_{it}$. That part of the error component subject to resampling is white noise ε_{it}. The procedure is as follows[29]:

(i)   A panel regression: $Y_{it} = X_{it}\beta + u_{it}$ is estimated

(ii)   Determine the random component of the error term (the unrestricted residuals):

$$\varepsilon_{it} = Y_{it} - (X_{it}\beta + \mu_i)$$

(iii)   The vector of the responses to the resampling process is given as:

$$Y^*_{bit} = \hat{Y}_{it} + \hat{\varepsilon}_{bit}, \text{ where } \hat{Y}_{it} = X_{it}\hat{\beta} + \mu_i$$

(iv)   The vector of bootstrap responses regressed for each cross-section and case-wise on exogenous variables is created to estimate a bootstrapped vector of coefficients $\overset{*}{Y}_{bit} = X_{it}\hat{\beta}^*_b + \mu_{bi} + \varepsilon_i$

(v)   The bootstrapped regression coefficients for each resample and each cross-section are B x k matrices, where B is the number of replications and k is the number of coefficients in each resample and cross-section used to estimate the distribution of $\hat{\beta}_k$.

After the bootstrapping procedure, confidence intervals are determined using the bootstrapped coefficients to make inference about the distribution of the true coefficient in the population under investigation. An α-level confidence interval, that is [(1-α) x100] %, is determined such that it possibly includes the true value of the parameter of the population investigated. The confidence interval is interpreted as the interval that carries a [(1-α) x100] % certainty that it would include the true value of the distribution of the population.

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[29] For more information on bootstrapping steps see also Money, C.Z. and Duval, R.D. 1993. *Bootstrapping: A nonparametric approach to statistical inference*. Sage Publications, International Educational and Professional Publisher. Newbury. London. New Delhi.

Thus, such confidence intervals contrast the traditional parametric confidence interval (it is here where the power of bootstrapping lies), which assumes that the distribution of the parameter of the population is known and that it has a normal or student t distribution; an assumption that may not always hold true.

Apart from defining confidence intervals, the determination of the magnitude of the bias of the estimated coefficients is important in validating the results of bootstrapping. The coefficient of regression is biased if the assumption of zero correlation ($H_o : E(\varepsilon_{it}/X_{it}) = 0$) between the error term, in this case ε_{it}, and the exogenous variable is violated. The magnitude of the bias of the estimated coefficient $\left(\hat{\beta} \right)$ is determined as follows:

$$Bias \quad (\hat{\beta}) = \beta - E(\hat{\beta})$$

Therefore, the distribution of bootstrapped sampling can be used directly to determine the magnitude of the bias of the estimated coefficient. Following Efron (1982), a good approximation of the bias of the estimated coefficient $\left(\hat{\beta} \right)$ is simply the difference between the expected value of the bootstrapping sampling distribution and the estimated coefficient $\left(\hat{\beta} \right)$:

$$Bias \quad (\hat{\beta}) = \hat{\beta} - \frac{\sum \hat{\beta}_b}{B}$$

Where $\hat{\beta}_b$ is the bootstrapped coefficient. This is equivalent to using the percentage standardised bias computed as follows:

$$Bias \quad (\hat{\beta}) = \left(\frac{\hat{\beta} - \hat{\beta}_b}{\sigma_{\hat{\beta}_b}} \right) x \ 100 \quad \%$$

This is the expression used to determine the magnitude of the bias, where $\sigma_{\hat{\beta}_b}$ is the standard deviation of the bootstrapped coefficient $\left(\hat{\beta}_b \right)$. The coefficient is biased if the

percentage standardised bias is greater than 28 per cent (see Bun and Kiviet, 2001 for the discussion on the acceptable levels of bias).

Next, the empirical results will be discussed to analyse the impact of retirement programs on saving, per capita growth and fertility.

Chapter 6: Empirical Results

This chapter presents the empirical results of the models outlined in the previous chapter. The chapter is divided into three sections. The first section presents the results of the model estimation of saving, with the investment/GDP ratio a proxy for saving. It is estimated as a fixed effect model for the fourteen countries included in the study divided into regions (economic blocks), to analyse the heterogeneity of these economic blocks in terms of their level of economic development. The second section presents the results of the growth model for all fourteen countries divided according to their blocks of economic development. The third section presents the results from the fertility model, where population growth is used as a proxy for net fertility rates (comprising the number of births per woman excluding infant mortality). That is the net number of children that present rearing and educational expenses to their parents, but could also possibly provide secured retirement to their parents.

6.1 The Saving Model

This section presents the results of the effect of social security on saving using a combination of models available in the literature. The proxy used for saving is the investment/GDP ratio. The assumption is that any current additional period investment is a reflection of expected future national saving[30]. The proxy is needed given the lack (deficiency) of data on saving for the countries under consideration. Thus, investment is assumed to be a close substitute to saving. The section starts by analysing the characteristics of the data through testing for the presence of unit root followed by the presentation and discussion of the results.

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[30] This flows from the national income identity consideration. Because of this identity any investment beyond the level of saving is equivalent to debt, which will require future saving for repayment.

6.1.1 Unit root testing

As outlined earlier this study analyses a panel of fourteen countries with seven variables, namely: investment, social security benefit payments, government consumption, government deficit as a proxy of government saving (dissaving), net exports, inflation and the growth of per capita GDP over a period of ten years from 1994 to 2003. All variables appear as a ratio to GDP with the exception of the growth of per capita GDP and inflation.

Based on Levin, Lin and Chu T* and the Breitung t-statistic, the common unit root test for growth of per capita GDP is significant at one and five per cent, respectively. This result implies that the growth of per capita GDP across countries is non-stationary. Im, Pesaran and Shin W-statistic, ADF-Fisher Chi-square and PP-Fisher Chi-square unit root tests (assume individual unit root process) show that the growth in per capita GDP across countries has unit root process (I(1)), which means that it is non-stationary. However, the unit root hypothesis is rejected at one per cent based on Hadri Z-statistic test. Thus, the variable per capita GDP has a unit root process at five per cent with individual effects and a linear trend.

The test of the null hypothesis of unit root for inflation is significant at one per cent for both tests based on Levin, Lin and Chu t* and the Breitung t-statistic, with no intercept and no trend. This result implies that inflation across countries has unit root process, that is, it is non-stationary for all countries when considered together. The test for unit root based on ADF-Fisher Chi-square and PP-Chi-square, assuming individual unit root process, with no intercept and no trend is significant at one per cent, that is, inflation is non-stationary.

The Breitung t-statistic test of unit root on the benefit/GDP ratio in natural logarithms rejects the null at ten per cent level of significance with no intercept and no trend. The unit root test based on Levin, Lin and Chu t* fails to reject the null at five per cent level of significance with no intercept and no trends. The unit root test based on ADF-Fisher Chi-square and PP-Chi-square fails to reject the null with no intercept and no trend at 10 per

cent level of significance. Therefore, it can be concluded that the variable benefit/GDP ratio in natural logs is stationary across countries.

The result of the unit root test on the variable investment/GDP ratio in natural logarithms indicates unit root process with individual effects. It also has a linear trend at one per cent based on Levin, Lin and Chu t* test and at five per cent based on the Breitung t-statistic test. However, the Hadri Z-statistic test fails to reject the null of no unit root at one per cent, implying that the investment/GDP ratio is stationary. These are contradictory results in terms of the validity of the test for unit root. The test for unit root based on the Im, Pesaran and Shin W-statistic, based on the assumption that each cross-section has unit root process, confirms unit root with individual effects and a linear trend at five per cent. The unit root test based on ADF-Fisher Chi-square and PP-Fisher Chi-square show unit root with individual effects and a linear trend at one per cent. Thus, the investment/GDP ratio is non-stationary (has unit root).

The result from Levin, Lin and Chu t* statistic, testing for unit root in the case of the government consumption/GDP ratio in natural logarithms, shows that the government consumption/GDP ratio has unit root with individual effects and a linear trend at one per cent level of significance. The Breitung t-statistic test on the other hand rejects the null of unit root at ten per cent. This rejection implies that the natural logarithm of the government consumption/GDP ratio is stationary. The Hadri Z-statistic fails to reject the null of no unit root, suggesting stationarity of this variable. Unit root test based on Im, Pesaran and Shin W-statistic and ADF–Fisher Chi-square also rejects the null of unit root with individual effects and an individual linear trend.

Another variable included in this model is government deficit (as a proxy of government saving or dissaving) to GDP ratio in levels. In this case the unit root test based on Levin, Lin and Chu t* statistic fails to reject the null of unit root with individual effects at one per cent level of significance and the Breitung t-statistics at five per cent. The Hadri Z-statistic also fails to reject the null of no unit root. Unit root tests based on the Im, Pesaran and Shin W-statistic, ADF–Fisher Chi-square and PP-Fisher Chi-square fail to reject the null of unit root. Therefore, it can be concluded that the government deficit/GDP ratio is a non-stationary variable, in other words it has unit root process.

Finally, net exports are included in the model. The Levin, Lin and Chu t* test for unit root on this variable (represented as a ratio to GDP) fails to reject the null of unit root at one per cent but the Breitung t-test rejects the null at conventional ten per cent. The Hadri Z-statistic fails to reject the null of no unit root. The Im, Pesaran and Shin W-statistic unit root test fails to reject the null of unit root at five per cent level of significance; while ADF–Fisher Chi-square and PP-Fisher Chi-square tests also fail to reject the null of unit root process at one per cent level of significance.

6.1.2 The results of the model

The basic model is estimated using the Least Square Dummy Variable (LSDV) estimation procedure and the results are presented in Table 6.1 column 2 (labelled Model 1). This model estimates the full sample, which includes 14 SSA countries.

The results of Model 1 (in column 2) show that social security crowds-out saving in the group of sub-Saharan African countries included in this study. The result confirms the effects of social security financed by a pay-as-you-go system on national saving in the life cycle models. There are two fundamental channels through which these effects occur: (i) the financing of implicit debt and (ii) the reduction of personal saving. The results of the coefficients from Model 1 have the expected signs according to various other theoretical models, with the exception of government consumption which has the wrong (positive) sign but is not statistically significant.

The coefficient for social security found in this study is similar to that of Ehrlich and Kim (2005) in their endogenous-growth model, where social security taxes to finance benefit payments are foreseen to have a negative effect on saving. However, Zhang and Zhang (2004) in a model where they investigate how social security interacts with growth and growth determinants, find that social security has a positive effect on saving. Cigno, *et al*. (2003) in a time-series analysis also found positive effects on saving, which contradicts the results found in this study and that of Ehrlich and Kim (2005) and Ehrlich and Zhong (1998).

Table 6.1: Dependent variable - *LnRinv* (full and regional samples)

Variables (Regressors)	Coefficients (First-order Asymptotic)		
	Model 1 (All Countries)	**Model 2 (SADC)**	**Model 3 (West Africa)**
LnRBen	-0.0062	0.0322	-0.0558
	(0.0330)	(0.0712)	(0.0336)
GPC	2.3448***	2.5371***	1.1126*
	(0.4812)	(0.8453)	(0.6392)
RNX	-0.5609**	-0.7988*	-0.6034**
	(0.2217)	(0.4368)	(0.2950)
LnRGC	0.0895	-0.2951	0.3846***
	(0.0813)	(0.2452)	(0.0776)
RDef	-0.7412*	-0.7411	-0.7901*
	(0.3789)	(0.7535)	(0.4670)
INFL	-0.0009***	-0.0008*	-0.0021**
	(0.0003)	(0.0004)	(0.0009)
Fixed Effects			
BENIN	-1.7116***		-1.3088***
	(0.2360)		(0.2053)
CAMEROON	-1.6757***		-1.3121***
	(0.2668)		(0.2364)
ETHIOPIA	-1.8878***		
	(0.2005)		
GHANA	-1.4450***		-1.1251***
	(0.2210)		(0.1996)
IVORY COST	-1.9600***		-1.6167***
	(0.2601)		(0.2279)
KENYA	-1.8122***		
	(0.3157)		
LESOTHO	-1.1194***	-1.6256***	
	(0.2103)	(0.4341)	
MALI	-1.5538***		-1.2953***
	(0.1686)		(0.1458)
MOZAMBIQUE	-1.2805***	-2.0523***	
	(0.2220)	(0.5865)	
NIGERIA	-1.3628***		-0.9634***
	(0.1986)		(0.1757)
SOUTH AFRICA	-1.7419***	-2.2666***	
	(0.1552)	(0.4201)	
SENEGAL	-1.5273***		-1.2911***

	(0.3222)	(0.2916)	
ZAMBIA	-1.7253***	-2.2832***	
	(0.2325)	(0.5764)	
ZIMBABWE	-1.7446***	-2.2846***	
	(0.1804)	(0.3534)	

$R^2 = 0.8632$	$R^2 = 0.8697$	$R^2 = 0.8817$
$R^2\text{-}Adj = 0.8416$	$R^2\text{-}Adj = 0.8363$	$R^2\text{-}Adj = 0.8567$
$F\text{-}stat = 39.8861$	$F\text{-}stat = 26.027$	$F\text{-}stat = 35.3866$
$p(F\text{-}stat) = 0.0000$	$p(F\text{-}stat) = 0.000$	$p(F\text{-}stat) = 0.000$

(Standard errors in parenthesis)

*** Significant at 1% level; ** Significant at 5% level and * Significant at 10% level

Note: for explanation of abbreviations see Chapter 5.

The results in Model 1 (see also the discussion in Chapter 4) indicate that large government deficits and the way they are financed have important negative effects on the economy's performance via a reduction in aggregate saving. Therefore, large social security expenditures accompanied by an increased dependence ratio and inflation, reduce national saving. Cesaratto (2003) indicated that the way private saving responds to government borrowing determines national saving, which can remain unchanged or even decrease. In developing countries and in particular sub-Saharan countries where saving rates are very low, government deficits are large and labour productivity low, borrowing to finance social security will aggravate the negative effect of PAYG systems. Therefore, the results in Model 1 regarding the effects of social security on saving in SSA are similar to the Cesaratto (2003) findings in that large government deficits tend to reduce public saving. National saving also tended to decrease, which adds to depressing the productivity of these countries.

In the case of SSA countries, the drop in national saving can be attributed to the reduction in personal saving, inflation and the deteriorating terms of trade and some other exogenous factors such as low labour productivity. As can be seen from Model 1 inflation has a negative sign and it is statistically significant at one per cent. Some may argue that inflation will induce precautionary saving but if individuals adjust their marginal propensity to consume, inflation will reduce saving as implied by the above result. The Government deficit also has a negative sign but is not statistically significant at the

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conventional levels. This is acceptable since governments tend to borrow more or raise taxes to finance deficits on their budgets.

Borrowing to finance retirement programs not only affects national saving in models where bequests are operative and the economy is growing at steady-state rates. If the assumption of steady-state growth is relaxed, which is the case in SSA countries with economic growth rates below the growth rates of the labour force, national saving declines. Taxes to finance retirement programs, under conditions of low productivity and low levels of economic activity, also affect private saving and thus national saving negatively, given the fact that government saving is also negative.

The growth in per capita income leads to an increase in saving in these economies. This result is acceptable and supported by both the theoretical claims. From a Keynesian perspective where individuals consume a fixed portion of their disposable income, growth in per capita GDP in real terms, *ceteris paribus*, will increase aggregated saving. In an economy where bequests are operative as in the Barro (1974) and latter Backer and Barro (1988) models the growth in per capita GDP will also lead to an increase in saving due to bequest motives and through investment in human capital as discussed in Section 6.3 below.

Model 1 suggests that specific factors that affect national saving exist in all countries. Some of these factors are institutionally important for the mobilisation of saving for retirement from rural areas where the majority of the population lives and the informal sector is also increasingly important. Other exogenous factors like instability and natural disasters lower productivity, especially in the agricultural sector, which inhibits growth in the industrial sector.

6.1.3 Testing for the validity of Model 1

Model 1 was estimated using a fixed effects Least Square Dummy Variable procedure, allowing for testing for fixed effects and homogeneity of the coefficients in the model. It also tests for the validity of exogeneity of the variables included in the model.

The test for fixed effects is the test for validity of the null hypothesis that there are no individual effects against the alternative of the presence of individual effects, that is:

$$H_O : \mu_1 = \mu_2 = \mu_3 = ... = \mu_{14} = 0 \; \blacktriangleright \text{ No individual effects}$$

$$H_A : \mu_1 \neq \mu_2 \neq \mu_3 \neq .... \neq \mu_{14} \neq 0 \blacktriangleright \text{ There are individual effects}$$

The test for fixed effects is an *F-test* and it is distributed as an *F-statistic* with [(N-1), (NT-N-K)] degrees of freedom: Where N is a number of cross-sections, T time dimension and K the number of coefficients estimated. The result of the test is $F_{(13,120)} = 16.4883$, which rejects the null of no individual effects (or common intercept) in favour of the existence of individual effects at the five per cent level of significance. This result suggests that certain of the SSA countries have different factors that affect saving behaviour, justifying therefore, the fixed effects model, rather than pooling all countries together.

The next step is to test whether countries have a common slope coefficient, in other words testing for homogeneity of the slope coefficient. This is to test whether the null of all coefficients is equal as opposed to all slope coefficients not being equal, that is:

$$H_O : \delta_1 = \delta_2 = \delta_3 = ... = \delta_{14} = \delta \; \blacktriangleright \text{ All coefficients are equal and therefore one slope}$$
$$\text{for all cross-sections}$$

$$H_A : \delta_1 \neq \delta_2 \neq \delta_3 \neq .... \neq \delta_{14} \neq \delta \; \blacktriangleright \text{ All coefficients are not equal and therefore each}$$

cross-section has its own coefficient; in other words the coefficients are not poolable.

The test for homogeneity of coefficients is an *F-test* and is distributed as an *F-statistic* with [(N-1)K, (N(T-K))] degrees of freedom. Where N, T and K are read as defined previously. The result of the test is $F_{78,56} = 11.8025$, which also rejects the null of poolability of coefficients at the five per cent level of significance in the full sample represented by Model 1.

Exogeneity of the variables in the Model 1 are also tested for through the Hausman test which is distributed as Chi-square with K degree of freedom ($\chi^2(K)$). The null hypothesis to be tested is $H_o : E(\varepsilon_{it}/\mathrm{X}_{it}) = 0$ which implies no misspecification in the model or correlation between individual effects and exogenous variables. The result of the test is $m = 6.8008$, which is less than the critical value of $\chi^2(6)$ and therefore fails to reject the null hypothesis at the one per cent level of significance, in other words no misspecification is detected.

The result of the test for serial correlation indicates no evidence of serial correlation. It is based on the LM test which is distributed as Chi-square with one degree of freedom (χ_1^2) under the null hypothesis of no serial correlation. The calculated LM test based on the RSS is equal to 4.6937, which is less than the critical value of χ_1^2 leading to failure of rejecting the null at one per cent level of significance.

6.1.4 Testing for the validity of alternative models (regional grouping)

Given the rejection of the poolability of the coefficient in the full sample and given the limited time-series data, the countries were divided into regional blocks. The assumption is that with the growing importance of regional blocks, policy coordination is more likely and, therefore, social security programs as well as other development programs are likely to cross borders[31]. In this regard, at regional level, countries tend to be more homogenous than considered at the continental level.

The results of the estimation from this exercise and using LSDV are also presented in Table 6.1. Model 2 (column 3) shows the results of the estimation for Southern African (SADC) countries. The coefficient of social security is positive but not statistically significant at conventional levels, implying that in the SADC region social security tends to crowd-in (or increase) saving but its effect is not significantly different from zero. This result is similar to the results found by Zhang and Zhang (2004).

All other variables have the expected signs but both government consumption and deficits are not significant at the conventional levels of significance. However, inflation and net exports have a negative impact on saving and both are statistically significant at ten per cent levels. Per capita GDP is also significant but only at one per cent level. The cross-sections effects are negative and are all statistically significant at one per cent.

We test the null hypothesis of no individual effects against the alternative that individual effects exist. The result of the test is $F_{(4,39)} = 3.5257$ which marginally rejects the null at five per cent level of significance. This result implies that countries do have different factors that affect their saving behaviour, justifying, therefore, a fixed effects model rather than pooling the countries all together.

The relevant test does not reveal the existence of serial correlation under the null of no serial correlation. The result of the calculated LM value is equal to 3.4525 and is distributed as Chi-square with one degree of freedom (χ_1^2). The value of the LM statistic is less than the critical value, leading to the acceptance of the null of no serial correlation at five per cent.

In another regional grouping of West African countries in Model 3 (column 4), the estimates from LSDV indicate that social security has a negative effect on saving and it is not statistically significant at the conventional levels of significance. This again confirms the validity of the life cycle hypothesis that social security financed by pay-as-you-go crowds-out saving.

All variables contain the expected signs with the exception of government consumption which has the wrong (positive) sign and is significant at one per cent. Net exports and inflation affect saving negatively and are statistically significant at one per cent. These results show that countries with high inflation save less than those with low inflation rates. Also countries exporting less than they import tend to have lower saving rates. Growth in per capita GDP increases national saving but is not statistically significant in this model.

[31] An example of this is the SADC charter (2003) which envisages policy coordination in the social security

As in the other two regions, the fixed effects are statistically significant at one per cent, indicating that there are individual effects influencing the behaviour of saving in these countries. Therefore, the estimation of the fixed effect LSDV model seems to be justifiable.

Tested for fixed effects, Model 3 rejects the null hypothesis of no individual effects. The result of the test is given as $F_{6,57} = 24.8614$ which rejects the null, implying that there are fixed effects in the model at five per cent level of significance.

The test for serial correlation shows no evidence of serial correlation. The LM test is equal to 4.5386 which is distributed as Chi-square with one degree of freedom (χ_1^2). The calculated LM value is less than the critical value, leading to the acceptance of the null hypothesis of no serial correlation.

6.1.5 Bootstrapping results

The reliance on asymptotic normal distribution assumptions may be misleading in the context of the small sample, in particular the short time span of the series in the panel data. Mooney and Duval (1993) and Judson and Owen (1996) suggest that bootstrapping constitutes an important instrument to rely on in the construction of the empirical distribution function (EDF), since it is based on data at hand. Therefore, many recent studies and tests have been relying more heavily on second order asymptotic properties like bootstrapping to reduce the size of the distortions relative to alternative methods (Kim, 2005). Although Kim claimed this advantage in regressions with auto-correlated errors, by allowing the construction of empirical distribution function, especially under the false null hypothesis[32] bootstrapping can be extremely useful in the case of data that are not normally distributed and particularly small sample panel data.

programs, especially those policies regarding the old age in the region.
[32] For the advantages of using bootstrapping in the regression models, see also Giersbergen and Kiviet (2002) and Bun and Kiviet (2001).

In this study the advantages of bootstrapping were employed to construct an empirical distribution function based on the available data and to determine the magnitude of the coefficients bias. However, in this exercise only models grouped at regional level (labelled Model 2 and 3) will be bootstrapped. Due to few cross-sections (only two, Kenya and Ethiopia) that do not allow for enough heterogeneity, the countries in the East African region will not be analysed separately.

Bootstrapping in this study was based on unrestricted residual resampling, where an equal number of cross-section equations is constructed on the basis of the first-order coefficient results. The unrestricted residuals are calculated in e-views 5 for the purpose of resampling. The argument behind the use of unrestricted residuals is based on the fact that unrestricted residuals "ensure that the EDF $\hat{F}_\varepsilon$ converges to the population distribution F_ε in a suitable metric even when the null hypothesis is false" (see Giersbergen and Kiviet, 2002). The results of bootstrapping based on unrestricted residuals seem to perform better than block resampling, especially in the absence of serial correlation. In fact, the use of block bootstrapping has frequently been employed in bootstrapping time series data to reduce possible effects of serial correlation in the results of the bootstrapped coefficients. However, it has also been shown (see the above authors) that using unrestricted residuals delivers good results, especially in small time series data, as is the case in this study.

The results of bootstrap are stored in two matrices created for this purpose with one used to store bootstrapped coefficients and the other to store bootstrapped fixed effects, from which empirical distribution functions are determined. The use of 10000 replications is justified due to the fact that this number of replications seemed to be sufficiently large to be used to compare with the results of the first-order asymptotic tests based on normality assumptions.

In tables 6.2 and 6.3 below, the first-order asymptotic theory approximation results are presented jointly with the second order asymptotic results (bootstrapping results), the bias of the coefficients, the confidence interval and the level of significance. The confidence intervals are based on bootstrapping results and rather than relying on conventional levels

of significance (1%, 5% and 10%) the study extended these levels of confidence to determine the most accurate levels based on used data.

From the bootstrapping results it is possible to see that some of the variables that were not significant at a conventional level of significance are now significant and others that were at certain level of significance, for example 10 per cent, after bootstrapping are now significant at lower levels of significance. This is important in terms of a comparison of the results based on normality assumptions and those based on the characteristics of the sample in hand. Normality assumes asymptotic properties that many macroeconomic variables do not possess.

The variable benefit/GDP ratio which was not significant for the SADC and West African countries first-order asymptotic theory approximation regression, still does not remain significant for the SADC countries even after bootstrapping. However, in West African countries it becomes significant at 10 per cent. These results show that relying on normal asymptotic properties may result in incorrect policy inferences. However, parametric bootstrapping as used in this study can be a powerful instrument for validity of parameters that are used for policy simulation[33]. This is evident in the case of West Africa where one could have rejected the effects of social security on saving at ten and one per cent respectively. In the case of SADC countries the coefficient of social security is not significant even at 35 per cent, but it has a positive sign leading to different policy implications compared to those for West Africa.

Other coefficients follow the same distributional pattern. Another advantage of bootstrapping is the fact that the researcher is no longer bound to strict levels of significance and is able to detect significance even at intermediate levels. For example, the deficit/GDP ratio which was only significant at ten per cent, is now significant at the six per cent level of significance after conducting the simulation. In SADC countries the coefficient of this variable indicated significance only at about 30 per cent but after

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[33] See annexure 3 and 4 for the distribution of the EDF of the coefficients of the variables in the models based on the data at hand.

bootstrapping simulation, significance showed at 15 per cent, a significant improvement in terms of the power of the test.

Next we address the policy implications that social security has on saving in African countries. In general social security has a negative effect on saving for West African countries. It is statistically significant at ten and one per cent respectively, with the exception of SADC countries where it shows that social security has a positive effect on saving but is not statistically significant. In the case of West African countries the suggestion is that reforms are important but they should be implemented with caution as suggested by Orszig and Stiglitz (1999) and many others. In the SADC countries the reforms should be directed at the improvement of management of the portfolio and diversification to increase the effects of social security on saving.

The results also show that a deficit in the current account balance (exports less imports), government consumption (except for West Africa) and government deficits have a negative effect on saving. However, government consumption, the current account balance and government deficits are only significant for West Africa. In the SADC countries only the current account balance is significant. The final results show that inflation crowds-out savings and is significant at one per cent for all regions.

In the group of countries included in the sample there are negative country specific factors that affect saving. This is of extreme importance in view of policy decisions with regard to saving behaviour in the presence of social security programs.

Some of these factors could be low productivity that limits an individual's income and therefore, consumption and saving. Low productivity in many SSA countries can result from labour force deficiencies such as lack of skills, natural disasters, instability and other exogenous factors that affect the level of production and saving, which can turn into a vicious circle if proper policy measures are not taken timeously.

Table 6.2: Dependent variable - *LnRinv* (SADC sample)

Regressors	First order asymptotic results (LSDV) Model 2 (SADC)	No of replications: 10000 Second order asymptotic results (Bootstrap)	Bias	Confidence interval LCI	UCI	Level of significance
LnRBen	0.0322	0.0322	0.000			Fails to reject the null at 10%
	(0.0712)		(0.00%)	-0.0778	0.1589	
GPC	2.5371***	2.5517	0.0146			Significant at 1%
	(0.8453)		(0.60%)	0.3869	4.6784	
RNX	-0.7988*	-0.8004	-0.0016			Significant at 1%
	(0.4368)		(0.20%)	-1.4682	-0.1042	
LnRGC	-0.2951	-0.2921	0.0030			Fails to reject the null at 10% [26%][1]
	(0.2452)		(1.00%)	-0.5859	-0.0012	
RDef	-0.7411	-0.7523	-0.0112			Fails to reject the null at 10% [15%][1]
	(0.7535)		(1.51%)	-1.5556	-0.0058	
INFL	-0.0008*	-0.0008	0.0000			Significant at 1%
	(0.0004)		(0.00%)	-0.0014	-0.0001	
Fixed Effects						
LESOTHO	-1.6256***	-1.6234	0.0022			Significant at 1%
	(0.4341)		(0.14%)	-3.0613	-0.1068	
MOZAMBIQUE	-2.0523***	-2.0466	0.0057			Significant at 1%
	(0.5865)		(0.28%)	-3.4562	-0.6341	
SOUTH AFRICA	-2.2666***	-2.2622	0.0044			Significant at 1%
	(0.4201)		(0.19%)	-3.4978	-0.9961	
ZAMBIA	-2.2832***	-2.2778	0.0054			Significant at 1%
	(0.5764)		(0.24%)	-3.6759	-0.8652	
ZIMBABWE	-2.2846***	-2.2816	0.0030			Significant at 1%
	(0.3534)		(0.13%)	-3.4804	-1.4066	

(Standard errors in parenthesis)

*** Significant at 1% level; ** Significant at 5% level and * Significant at 10% level

[1] The variables are not significant at 10 per cent but significant at 26 and 15 per cent level of significance, respectively

Table 6.3: Dependent variable - *LnRinv* (West Africa sample)

Regressors	First order asymptotic results (LSDV)		Second order asymptotic results (Bootstrap)	Confidence interval			Level of significance
	Model 4 (West Africa)		No of replications: 10000	Bias	LCI	UCI	
LnRBen	-0.0558			-0.0006			
	(0.0336)		-0.0564	(1.08%)	-0.1143	-0.0004	Significant at 10%
GPC	1.1126*			-0.0008			
	(0.6392)		1.1118	(0.07%)	0.05510	2.2139	Significant at 5%
RNX	-0.6034**			-0.0007			
	(0.2950)		-0.6027	(0.12%)	-1.1312	-0.1200	Significant at 5%
LnRGC	0.3846***			0.0008			
	(0.0776)		0.3854	(0.21%)	0.2125	0.5567	Significant at 5%
RDef	-0.7901*			-0.0010			
	(0.4670)		-0.7891	(0.13%)	-1.5866	-0.0151	Significant at 6%
INFL	-0.0021**			0.0000			
	(0.0009)		-0.0021	(0.00%)	-0.0040	-0.0003	Significant at 1%
Fixed Effects							
CAMEROON	-1.3121***			0.0021			
	(0.2364)		-1.3100	(0.16%)	-1.3100	-0.7550	Significant at 1%
GHANA	-1.1251***			-0.0008			
	(0.1996)		-1.1259	(0.07%)	-1.3138	-0.7436	Significant at 1%
BENIN	-1.3088***			-0.0050			
	(0.2053)		-1.3138	(0.38%)	-1.7508	-0.5100	Significant at 1%
IVORY COST	-1.6167***			-0.0021			
	(0.2279)		-1.6188	(0.13%)	-2.2343	-1.0361	Significant at 1%
NIGERIA	-0.9634***			-0.0006			
	(0.1757)		-0.9640	(0.06%)	-1.9995	-0.6253	Significant at 1%
SENEGAL	-1.2911***			0.0051			
	(0.2916)		-1.2962	(0.40%)	-1.6658	-0.2901	Significant at 1%
MALI	-1.2953***			0.0013			
	(0.1458)		-1.2940	(0.10%)	-2.1080	-0.5454	Significant at 1%

(Standard errors in parenthesis)

*** Significant at 1% level; ** Significant at 5% level and * Significant at 10% level

6.2 An Example of Country Specificity – The Case of South Africa

6.2.1 Introduction and model

Using Feldstein's (1974) specification an attempt was made to quantify the extent to which retirement benefits in South Africa affected personal saving between 1970 and 2003. Consumption is estimated as a function of disposable labour-income and pension and provident benefits (both official and privately administered):

$$ConsPC = f(Y_dPC, Y_dPC(-1), TBENPC)$$

where ConsPC is real per capita consumption, Y_dPC is real per capita disposable labour income and TBENPC is real per capita total pension and provident fund benefits.

6.2.2 Data and empirical results

All data used in this study have been obtained from *South African Reserve Bank (SARB) Quarterly Bulletin* and data on population numbers were sourced from the publication *World Development Indicators (2005)*, comprising a range of 34 years.

We conducted unit root tests on all variables in the model. The results of the Augmented Dickey-Fuller and KPSS tests show that all variables (in natural logarithms and in levels) are I(0) except the interacted unemployment variable, consumption per capita and both total and privately administered pension benefits, which are I(1). The results show that almost all household labour disposable income in South Africa is spent on consumption (0.98).

In the case of total payouts from retirement funds both privately and officially administered (Regression 1 in Table 6.4) the marginal propensity to consume amounts to about 0.06, which is more than double the coefficient (0.028) for the US as estimated by Feldstein (1995), and is statistically significant. These results suggest that such benefits have a significant impact on consumption in South Africa and the way in which they are

taxed will strongly impact on saving via consumption during the life cycle of an individual.

Regression 1 is re-estimated in Regression 2 (see Table 6.4) by substituting total benefits paid, by the benefits paid by pension and provident funds privately administered (TPAPPPC). In this regression the marginal propensity to consume now increases to 0.11, which is almost double the marginal propensity to consume as measured in Regression 1 and is statistically significant. The results show that for each rand paid as benefit by a privately administered pension fund, 11 cents will be spent on consumption.

Table 6.4: Dependent Variable - Per Capita Consumption (ConsPC) – Feldstein (1974, 1995) Specification

Variables	Regression 1	Regression 2
YdPC	0.984 (0.1798)	0.931 (0.1595)
YdPC(-1)	0.445 (0.1518)	0.401 (0.1360)
TBENPC	0.055 (0.0063)	
TPAPPPC		0.112 (0.0111)

(Standard errors in parenthesis)

The approach is that a tax on benefits reduces the expected benefits (returns) on such investment and depending on the level of taxation, individuals will seek other forms of savings, like buying property or investing in assets other than pension and provident funds. Thus, the tax treatment given to pension funds in South Africa can have adverse effects on saving for retirement through the pension funds, depending on how individuals perceive their benefits during retirement.

Estimating the coefficients based on the Feldstein model, the effects of pension and provident fund benefits paid on consumption and savings were estimated for 1996 (one year after the Katz Commission and Smith Committee) and again in 2003, eight years thereafter.

The results of these calculations show that total benefits received from pension funds led to increased consumption of R1.56 billion in 1996, and R2.79 billion in 2003, implying a reduction in saving of the same amount. During 1996, contributions to retirement funds

amounted to a R25.8 billion reduction in consumption and a R420 million reduction in saving. The corresponding amounts were R40 billion in consumption and R651 million in discretionary savings in 2003.

The combined effect on saving of benefits received from and contributions to pension and provident funds during 1996 were R1.98 billion and in 2003 it increased to R3.441 billion. This implies that household potential discretionary saving was reduced by 4.0 per cent in 1996 and by 6.92 per cent in 2003. These results are comparable to findings from studies for other countries. The decline in household saving in South Africa is also supported by time-series analyses done by Aron and Muellbauer (2000) and Prinsloo (1994, 2002).

The results, in Regression 2 show that discretionary household saving, when only administered funds are considered, is crowded out more than when private and public funds are combined. When the results from Regression 2 (shown in the fifth row of Table 6.4) are applied to the monetary values of privately administered funds, it shows that consumption increased by R2.0 billion in 1996 and by R3.6 billion in 2003. By repeating the exercise for privately administered funds we find that the combined effects on saving was R3.0 million and R5.2 billion for 1996 and 2003 respectively, which implies a reduction in potential saving of 5.3 per cent for 1996 and 10.1 per cent for 2003 (worse than when privately and officially administered schemes are combined).

These results indicate the dominant effect of pension and provident funds privately administered. Not being able to separate pension from provident funds, may lead to a serious bias in the analysis due to the fact that provident funds may have a different impact on saving and consumption in the life cycle of individuals.

Ehrlich and Kim (2005) analysed the effects of different retirement schemes and found that provident funds provide a better retirement deal to the aged than social security financed payroll taxes. However, in the South African case where contributions are capped as a percentage of remuneration, its effects are likely to be similar to those of social security in other countries. Both programs lower disposable labour-income, which is at the centre of household decision-making during their lifetime earnings. In South Africa, however, it is not possible to separate the effects of provident from pension funds, since

both are lumped together. However, these results could be regarded as directly comparable to the pure social security programs financed by payroll taxes in the US.

6.2.3 Conclusion regarding findings on the South African case

The results suggest that both in 1996 and 2003, social security (as represented by retirement benefits received) crowded out discretionary savings by 4.3 per cent and 7.5 per cent, respectively. These results are comparable with findings from studies in other countries.

The implication thereof is that policy change towards increased levels of social security contributions, could increase the crowding out of discretionary saving. In a life cycle hypothesis context individuals tend to maintain their consumption patterns during their life span. Thus, changes in the tax regime affecting the discounted value of retirement benefits will change savings in the opposite direction of the policy change.

6.3 Growth Model

This section analyses the effects of social security on the growth of per capita income. The results so far of the effect of social security on the growth of per capita income, have been inconclusive. Some were found to be positive while others were negative.

This section presents empirical results of the growth model. Fourteen sub-Saharan African countries are presented to verify the validity of the effect of social security on growth. The model uses the general specification on the effect of social security as frequently found in the literature. However, before the results of the model are presented, unit root tests of the variables included in the model are presented. The results of the model are followed by tests for their validity.

6.3.1 Unit root test

The study in this section analyses a panel of fourteen countries with seven variables, namely: secondary school enrolment, social security benefit payments, government

consumption, openness (defined as exports plus imports divided by GDP), inflation and the growth of per capita GDP. All variables appear as ratios of GDP with the exception of the growth of per capita GDP, inflation and secondary school enrolment (defined as a percentage of gross enrolment).

The test of the null hypothesis that openness (in logarithmic forms) has unit root process is accepted by Levin, Lin and Chu T* test only. Breitung t-statistic test rejects the null and the null of no unit root based on Hadri Z-statistic is accepted. However, the null of unit root based on the Im, Pesaran and Shin W-statistic, ADF-Fisher Chi-square and PP-Fisher Chi-square tests that assumes individual unit root process, fails to reject the null in the case of the variable openness. Combining the unit root results based on tests assuming individual unit root process and those assuming common unit root process, it is concluded that the openness variable has unit root with intercept and trend.

The unit root test for growth of per capita GDP is significant at one and five per cent based on the Levin, Lin and Chu T* and Breitung t-statistic tests respectively. This result implies that the growth of per capita GDP across countries is non-stationary. The test for unit root based on Im, Pesaran and Shin W-statistic, ADF-Fisher Chi-square and PP-Fisher Chi-square tests concludes that the growth of per capita GDP across countries has unit root or is non-stationary. However, the unit root hypothesis is rejected at one per cent with the test based on Breitung t-statistic. Therefore, the variable GDP per capita can be regarded as having a unit root process at 5 per cent with individual effects and a linear trend.

The test of the null hypothesis that inflation is non-stationary is significant at one per cent for the Levin, Lin and Chu T* and Breitung t-statistic and with no intercept and no trend. This result implies that inflation across countries has unit root process, that is, it is non-stationary. The unit root tests based on ADF-Fisher Chi-square and PP-Chi-square, assuming individual unit root process with no intercept and no trend are significant at one per cent, that is, inflation has unit root or is non-stationary.

The tests for unit root for the remaining variables included in this model are presented in Section 6.1.1.

6.3.2 The results of the model

The basic model is estimated, as in the case of the saving model, using the Least Square Dummy Variable (LSDV) procedure and the results are presented in Table 6.4 column 2 (labelled Model 1).

These results show that social security impacts negatively on the growth of per capita GDP, but that it is not statistically significant. The non-significance of the social security coefficient may imply that social security in the sub-Saharan African countries included in the study is being neglected. Or it may imply that a larger part of the population are not members of the formal social security schemes, or poor data recording leads to conflicting results since this has been a problem in most developing countries and the SSA countries in particular. This phenomenon is of great concern in view of the effect of social security on the performance of these economies, especially poverty alleviation for the aged and growth in the informal sector. This result, however, corroborates with the Ehrlich and Zhong (1998) and Ehrlich and Kim (2005) results where they found a negative relationship between social security benefit payments and the growth in per capita GDP. However, the magnitude of the effect in the set of poor countries was significantly smaller or insignificant. This result contradicts that of Zhang and Zhang (2004), who found a positive relationship between social security and the growth in per capita GDP after they had controlled for the initial GDP. In this study the results remain essentially unchanged even after controlling for initial per capita GDP.

Regarding the results of the saving model (Section 6.1), they also confirm the results of the life-cycle models with regard to the effect of social security on the economy's performance. Investment will be negatively affected if social security reduces personal saving (except when national saving increases more than the drop in personal saving to compensate for the decrease in personal saving). Thus, following the transmission mechanism, the growth in per capita GDP will also be negatively affected. This is acceptable since the growth of an economy can only occur if there is investment, which according to the assumption in this study is equal to saving in the national identity income equation.

Therefore, reforming the existing social security systems in many SSA countries seems to be urgent. However, such reforms do not necessarily imply privatisation of the systems given the weaknesses regarding regulation and monitoring of the institutions.

Another interesting result, although not statistically significant, but also in line with the Ehrlich and Kim (2005) results, is that education attainment (represented here as secondary school enrolment) may negatively affect the growth in per capita GDP of the SSA countries. The inadequate quality of education, lack of job opportunities, high fertility rates and other exogenous factors like drought and instability affect the growth of GDP.

Table 6.5: Dependent variable - *GPC* (Full and regional samples)

Variables (Regressors)	Coefficients (First-order Asymptotic)		
	Model 1 (All Countries)	Model 2 (SADC)	Model 3 (West Africa)
LnRGC	-0.0073	-0.0037	-0.0081
	(0.0147)	(0.0449)	(0.0177)
LnRBen	-0.0056	-0.0029	-0.0051
	(0.0056)	(0.0132)	(0.0069)
INFL	-0.0001***	-0.0001	-0.0004*
	(0.0001)	(0.00008)	(0.0002)
LnOpen	-0.010	-0.0240	0.0108
	(0.0174)	(0.0335)	(0.0215)
LnSEC	-0.0290	-0.0670	-0.0138
	(0.0178)	(0.0676)	(0.0193)
LnRinv	0.0675***	0.0884***	0.0402*
	(0.0145)	(0.0253)	(0.0240)
Fixed Effects			
BENIN	0.0325		0.0371
	(0.0523)		(0.0618)
CAMEROON	0.0271		0.0244
	(0.0553)		(0.0639)
ETHIOPIA	0.0400		
	(0.0507)		
GHANA	0.0398		0.0321
	(0.0443)		(0.0486)
IVORY COST	0.0371		0.0147
	(0.0560)		(0.0662)

KENYA	0.0168		
	(0.0629)		
LESOTHO	0.0067	0.0008	
	(0.0353)	(0.0829)	
MALI	0.0227		0.0305
	(0.0459)		(0.0588)
MOZAMBIQUE	0.0230	-0.0359	
	(0.0530)	(0.1460)	
NIGERIA	0.0363		0.0233
	(0.0410)		(0.0444)
SOUTH AFRICA	0.0976**	0.1374	
	(0.0385)	(0.1161)	
SENEGAL	0.0101		0.0102
	(0.0632)		(0.0741)
ZAMBIA	0.0267	0.0274	
	(0.0496)	(0.1201)	
ZIMBABWE	0.0837**	0.1013	
	(0.0389)	(0.1023)	
$R^2 = 0.4868$		$R^2 = 0.5406$	$R^2 = 0.3831$
$R^2\text{-}Adj = 0.4056$		$R^2\text{-}Adj = 0.4228$	$R^2\text{-}Adj = 0.2532$
$F\text{-}stat = 5.9912$		$F\text{-}stat = 4.5893$	$F\text{-}stat = 2.9500$
$p(F\text{-}stat) = 0.0000$		$p(F\text{-}stat) = 0.0003$	$p(F\text{-}stat) = 0.0030$

(Standard errors in parenthesis)

*** Significant at 1% level; ** Significant at 5% level and * Significant at 10% level

These factors suggest that it is not educational output *per se* that increases the growth in per capita GDP, but the combination of educational output and other factors affecting the two variables, namely: GDP and population. Dependence ratios (which are high in many SSA countries) and the structure of the population, for example, also affect the growth in per capita GDP.

Openness has a negative sign but is not statistically significant. This result is important from a policy perspective, since a negative sign may imply that most of the SSA countries import more consumption goods than they export. It is normally not growth enhancing and thereby affects the growth of their economies negatively. However, the variable investment has a positive sign and is significant at one per cent, meaning that investment

has an important effect on the growth of per capita GDP. Inflation has a negative sign and is statistically significant (though the magnitude is very small) supporting the theoretical claim that countries with higher inflation will have low GDP growth rates. With higher inflation individuals tend to save in foreign stable currencies which drain resources out of the country and/or durable goods (generally real estate) whose value grows with inflation. In the case of the majority of sub-Saharan African countries where the population is featured by a lack of resources for such shifts, the impact of inflation is more painful than in other parts of the world.

The results in Model 1 indicate that all countries have positive specific effects influencing the growth of per capita GDP, but almost all these specific factors are not significant except for South Africa and Zimbabwe, which are both significant at five per cent level of significance.

6.3.3 Testing for the validity of Model 1

Model 1 of this section was estimated using the fixed effects Least Square Dummy Variable procedure, allowing for testing of fixed effects and homogeneity of the coefficients in the model. It also tests for the validity of exogeneity of the variables included.

The test for fixed effects, tests the validity of the null hypothesis that no individual effects exist against the alternative that they do exist, that is:

$H_O : \mu_1 = \mu_2 = \mu_3 = ... = \mu_{14} = 0$ ➜ No individual effects

$H_A : \mu_1 \neq \mu_2 \neq \mu_3 \neq .... \neq \mu_{14} \neq 0$ ➜ Individual effects exist

The test for fixed effects is an *F-test* and is distributed as an *F-statistic* with [(N-1), (NT-N-K)] degrees of freedom, where N is a number of cross-sections, T the time dimension and K the number of coefficients estimated. The result of the test is $F_{(13,120)} = 1.79$ which accepts the null of no individual effects (or common intercept) at five per cent level of

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significance. Therefore, there are no specific factors that affect the growth of the SSA countries included in the model.

The next step is to test whether the countries included have a common slope coefficient, in other words testing for homogeneity of the slope coefficient. This is to test whether the null of all coefficients is equal against the alternative that not all slope coefficients are, that is:

$$H_O : \delta_1 = \delta_2 = \delta_3 = \ldots\ldots = \delta_{14} = \delta \; ➤ \; \text{All coefficients are equal and therefore one slope}$$

for all cross-sections

$$H_A : \delta_1 \neq \delta_2 \neq \delta_3 \neq \ldots\ldots \neq \delta_{14} \neq \delta \; ➤ \; \text{Not all coefficients are equal and therefore each}$$

cross-section has its own coefficient; in other words, coefficients are not poolable.

The test for homogeneity of coefficient is an *F-test* and is distributed as an *F-statistic* with [(N-1)K, (N(T-K))] degrees of freedom. Where N, T and K are read as defined previously. The test accepts the null of poolability of coefficients at five per cent level of significance in the full sample represented by model 1.

It also tests for exogeneity of the variable in Model 1 using the Houseman test which is distributed as Chi-square with K degrees of Freedom ($\chi^2(K)$). The null hypothesis to be tested is $H_o : E(\varepsilon_{it}/X_{it}) = 0$, which implies no misspecification in the model or no correlation between individual effects and exogenous variables. The result of the test is $m = 11.3604$, which is less than the critical value of $\chi^2(6)$ failing to rejects the null hypothesis at one per cent level of significance.

The result of the test for serial correlation shows no such evidence. It is based on the LM test distributed as Chi-square with one degree of freedom (χ_1^2) under the null hypothesis of no serial correlation. The calculated LM test based on the test of RSS is equal to 0.9079, which is less than the critical value of χ_1^2 resulting in failure to reject the null at one per cent level of significance.

6.3.4 Testing for the validity of alternative models (regional grouping)

In this section countries were again divided into regional blocks of economic development and/or according to their location. The assumption is that with the growing importance of regional blocks, policy coordination is more likely and therefore, social security programs as well as other development programs are likely to cross borders. Countries at regional level tend to be more homogenous than when considered at continental level.

The results of the estimation from this exercise and using LSDV are also presented in Table 6.4 above. Model 2 (column 3) shows the results of the estimation for the southern African (SADC) countries. The coefficient of social security is negative but not statistically significant, implying that in the SADC region, although social security is negatively related to the growth of per capita GDP, its effect is not significantly different from zero. In other words, social security within the group of SADC countries included in this study has no effect on the growth of per capita GDP. This result is similar to those found by Ehrlich and Zhong (1998) and Ehrlich and Kim (2005), with the only difference being their coefficients are statistically significant.

All control variables have the expected signs but are not significant at the conventional levels of significance with the exception of the investment/GDP ratio which is significant at one per cent. The specific effects are positive for all countries except for Mozambique, in whose case it is negative. For all countries the effects are not significant at conventional levels.

The result of the test for the validity of the null hypothesis of no individual effects against the alternative that individual effects exist is $F_{(4,39)} = 1.55$, which fails to reject the null. This result implies that countries' specifics play no role in the growth of the countries included in this model.

Serial correlation is rejected under the null hypothesis of no serial correlation. The calculated LM value is equal to 0.1811 and is distributed as Chi-square with one degree of

freedom (χ_1^2). The value of the LM statistic is less than the critical value, resulting in the acceptance of the null of no serial correlation at five per cent.

In the West African countries in Model 3 (column 4) the estimates from LSDV indicate that social security has a negative effect on the growth of per capita GDP but is not statistically significant. This result is again similar to the results found by Ehrlich and Zhong (1998) and Ehrlich and Kim (2005), with the only difference that their coefficients are significant.

All control variables have the expected signs but they are not significant with the exception of inflation and the investment/GDP ratio which are both significant at ten per cent. The fixed effects, as in the other two regions, are positive but not statistically significant, indicating that specific effects play no role in the behaviour of the growth of per capita GDP. Tested for fixed effects, Model 4 failed to reject the null hypothesis of no individual effects. The result of the *F-test* is $F_{6,57} = 0.6713$ which implies that there are no country specific factors affecting the growth of per capita GDP in the West African region.

No evidence of serial correlation is revealed. The LM test is equal to 2.9001, which is distributed as Chi-square with one degree of freedom (χ_1^2). The calculated LM value is less than the critical value at five per cent, leading to the acceptance of the null hypothesis of no serial correlation.

6.3.5 The results of pooled models

Tests for poolability of the growth models in both full sample and regional groupings suggest that countries are poolable. Thus, the growth models were run in pooled format and the results are presented in the Table 6.5.

The results shown in Table 6.5 (Model 4) indicate that social security is positively related to the growth of per capita GDP, which is opposite to the results in the LSDV regression above. These results are, however, similar to the findings by Zhang and Zhang (2004) in their panel data analysis and Cigno *et al.* (2003) in a time-series regression. The

differences in the results in the LSDV regression and least square pooled regression have important policy implications for social security in SSA countries. These policy implications will be discussed in the next chapter. For now it is important to note that social security has a positive sign although not statistically significant.

Table 6.6: Dependent variable - *GPC* (full and regional samples-pooled regressions)

Variables (Regressors)	Coefficients (First-order asymptotic)		
	Model 4 (All Countries)	**Model 5 (SADC)**	**Model 6 (West Africa)**
LnRGC	-0.0149*	-0.0429	-0.0077
	(0.0084)	(0.0334)	(0.0141)
LnRBen	0.0010	0.0060	-0.0022
	(0.0015)	(0.0062)	(0.0021)
INFL	-0.0001**	-0.0001	-0.0003**
	(0.00005)	(0.0001)	(0.0002)
LnOpen	-0.0197**	-0.0196	-0.0078
	(0.0084)	(0.0242)	(0.0103)
LnSEC	-0.0038	0.0026	-0.0067
	(0.0055)	(0.0142)	(0.0106)
LnRinv	0.0476***	0.0559***	0.0494***
	(0.0082)	(0.0167)	(0.0130)
Constant	0.0533***	0.0477	0.0550**
	(0.0162)	(0.0469)	(0.0217)
$R^2 = 0.3882$		$R^2 = 0.4695$	$R^2 = 0.3396$
R^2-Adj = 0.3606		R^2-Adj = 0.3955	R^2-Adj = 0.2767
F-stat = 514.0653		F-stat = 6.3421	F-stat = 5.3983
p(F-stat) = 0.0000		p(F-stat) = 0.0000	p(F-stat) = 0.0000

(Standard errors in parenthesis)

*** Significant at 1% level; ** Significant at 5% level and * Significant at 10% level

All control variables in the least square pooled regression have the same signs as in the LSDV. However, government consumption/GDP ratio and openness, which were not significant in the LSDV fixed effects regression, appear to be significant in the least square pooled regression. Secondary school enrolment is still insignificant at the conventional levels.

The test for serial correlation in the least square pooled regression based on the LM test shows no serial correlation. The result of the LM test is equal to 2.2172, which is distributed as χ_1^2. This is less than the critical value at five per cent resulting in acceptance of the null of no serial correlation in the residuals. Testing for variable omission in the pooled model using Wald test and both tests: *F-test* and Likelihood ratio (LR), rejects the null that the series included in the model do not belong to the equation at the one per cent level. The Wald test is equivalent to the Houseman test for misspecification; therefore, the results show no misspecification in the equation.

In column 3 the results of the least square pooled Model 2 are presented as Model 5. These results show that social security is positively related to the growth of per capita GDP in SADC countries. However, it is not statistically significant at conventional levels. As in the case of the full sample, these results are similar to those of Zhang and Zhang (2004) and Cigno *et al.* (2003).

The results of the control variables in the least square pooled model are similar to those obtained in the LSDV regression with the exception of secondary school enrolment of which the sign has changed but which is still not statistically significant at the conventional levels.

The result of the test on serial correlation is given by the LM test, distributed as χ_1^2. This LM test result is 0.2104, which accepts the null of no serial correlation in the residuals with the calculated value less than the critical value at five per cent. The result of the Wald test for omitted variables shows no misspecification of the model.

The pooled results for West Africa show that social security is negatively related to the growth of per capita GDP but not statistically significant. There is no significant difference between the least square pooled regression and LSDV regression results. Again this result may have important implications for retirement programs in these countries where generous social security programs are still common, despite high levels of poverty.

The results of the control variables are also basically unchanged from the results of the LSDV regression, with the exception of openness which has the opposite sign but is still not significant at conventional levels. The investment/GDP ratio and inflation which were only significant at ten percent in the LSDV regression are now significant at one and five per cent, respectively.

The LM test for the least square pooled regression shows no serial correlation, since the result of the LM test (2.8612) is less than the critical value at five per cent suggesting no serial correlation in the relevant residuals. The test for omitted variables or misspecification indicates that there are no omitted variables or misspecification in the model. This conclusion is supported by the results of the linear normalised restriction which reject the null that each of the variables is equal to zero for all variables included in the model.

6.3.6 Bootstrapping results

As was argued in Section 6.1.5, the reliance on normal asymptotic assumptions may be misleading in the context of a small sample, in particular short time-series in the panel data. Therefore, the use of bootstrapping reduces the size of distortions relative to the alternative methods and also helps to capture the properties of the data available, which is important when validating the results of the models.

In this section we bootstrap the results of the LSDV models as done in Section 6.1.5, that is, only the regional LSDV regressions are bootstrapped. This is important in order to be able to validate the results of the regressions. The advantages of this procedure were discussed in sections 5.3 and 6.1.4. The results of bootstrapping are presented in tables 6.6 and 6.7 below.

The results shown in Table 6.6 indicate that social security is negatively related to the growth of per capita GDP in SADC countries but not statistically significant at the conventional levels (significant only at 84,5 per cent, which is slightly higher than the level of significance given in the LSDV regression).

This answer implies that reliance on the LSDV results based on normality assumption, may lead to the wrong conclusions. Therefore, using bootstrapping may improve the quality of statistical power by allowing constructing confidence intervals (or tests) based on an empirical probability distribution function.

The results of estimated bootstrapping coefficients confirm the LSDV results since the computed standardised bias[34] are below the threshold of 28 per cent. This is important in validating the magnitude and signs of the estimated coefficients at the same time improving the power of the test. For example, social security is only significant at 84.5 per cent instead of 82.6 per cent in the LSDV test. In general it can be concluded that social security has no effect on the growth of per capita GDP in the SADC countries.

All the control variables have the correct signs with the exception of openness which has the opposite sign. Again bootstrapping improves the level of significance. For example, in the case of openness which was significant at 47.9 per cent, after bootstrapping the level of significance is 40.0 per cent and in the case of inflation which was significant at 18.7 per cent, after bootstrapping the level of significance is 22 per cent. These results reveal that if one relied on the assumptions of normality one could have taken the wrong decisions. For example, concluding that inflation is significant at 18.7 while the true level of significance is 22 per cent (the probability of committing type I error reduces). The same applies for the other results. Annexure 6 contains the distribution of bootstrapped coefficients based on 10,000 replications. This distribution shows that bootstrapping the results improves the distribution of the coefficients and therefore improves the confidence in the results obtained.

All the country specific effects are not significant confirming the early results from the LSDV regressions. Only South Africa has country specific effects significant at 40 per cent; while all other countries in the region have no significant specific effects even at 50 per cent. Again if one is to depend only on assumptions of normality the country specific

effects in South Africa would be recorded at 24.4 per cent (higher probability of committing type I error) while in reality they are only significant at 40 per cent.

The use of bootstrapping improves the power of empirical tests either in dynamic or static models (Kim, 2005; Giersbergen and Kiviet, 2002 and Bun and Kiviet, 2004). This is even more important in the context of small data series which characterise many developing countries, in particular sub-Saharan countries.

Table 6.7 contains results from bootstrapping simulations of the LSDV West Africa. In this table it is shown that social security is negatively related to the growth in per capita GDP as in the case of the SADC countries. This result is similar to the results found by Ehrlich and Zhong (1998) and Ehrlich and Kim (2005). However, it is not statistically significant at conventional levels and is only significant at 35.6 per cent after bootstrapping. This level of significance is significantly different from the result found for SADC countries.

Bootstrapping the coefficient of social security shows that the true level of significance is far below the level of significance shown in the first order asymptotic equation. Bootstrapping significantly improves the power of the test especially in the small sample. The calculated bias suggests that the coefficient social security is not biased, again important for relying on the results of regression for policy simulations.

The results on the control variables show that only the inflation and investment ratios are statistically significant within the conventional levels of significance. All other variables are not statistically significant within the conventional levels although the results from bootstrapping show significant improvements in the power of the tests. For example, secondary school education which was significant at 47.8 per cent, after bootstrapping the LSDV result becomes significant at 18.7 per cent. Therefore, the combination of these

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[34] The percentage standardized bias is calculated using
$$Bias \; (\hat{\beta}) = \left(\frac{\hat{\beta} - \hat{\beta}_b}{\hat{\sigma}_{\hat{\beta}_b}} \right) x \; 100 \; \%$$
(see also Chapter 5 on methodology).

techniques improves the quality of the results and also improves the quality of information for policy simulations.

The results of country specific effects are not significant even after bootstrapping and the power of the test for some country specific effects has decreased, that is, increased the probability of accepting the false null hypothesis. For example, the power of the test has decreased by 17.14 per cent for Ghana and 19.06 per cent for Nigeria.

Table 6.7: Dependent variable - *GPC* (SADC sample)

Regressors	First Order Asymptotic Results (LSDV)		Confidence Interval			Level of Significance
		No of Replications: 10000				
	Model 2 (SADC)	Second Order Asymptotic Results (Bootstrap)	Bias	LCI	UCI	
LnRGC	-0.0037	-0.0029	0.0008	-0.0776	0.0720	Fail to reject the null
	(0.0449)					at 10%
LnRBen	-0.0029	-0.0030	-0.0001	-0.0241	0.0185	Fail to reject the null
	(0.0132)					at 10%
INFL	-0.0001	-0.0001	0.0000	-0.0002	0.0001	Fail to reject the null
	(0.0001)					at 10% [22%][1]
LnOpen	-0.0240	-0.0244	-0.0004	-0.0713	0.0213	Fail to reject the null
	(0.0335)					at 10% [40%][1]
LnSEC	-0.0670	-0.0672	-0.0002	-0.1703	0.0334	Fail to reject the null
	(0.0676)					at 10% [29.5%][1]
LnRinv	0.0884***	0.0886	0.0002	0.0218	0.1589	
	(0.0306)					Significant at 1%
Fixed Effects						
LESOTHO	0.0008	0.0017	0.0009	-02291	0.2296	Fail to reject the null
	(0.0829)					at 10%
MOZAMBIQUE	-0.0359	-0.0346	0.0013	-0.3271	0.2586	Fail to reject the null
	(0.1460)					at 10%
SOUTH AFRICA	0.1374	0.1387	0.0013	-0.1269	0.4101	Fail to reject the null
	(0.1161)					at 10% [40%][2]
ZAMBIA	0.0274	0.0284	0.001	-0.1749	0.2335	Fail to reject the null
	(0.1201)					at 10%
ZIMBABWE	0.1013	0.1025	0.0012	-0.1015	0.3073	Fail to reject the null
	(0.1023)					at 10%

(Standard errors in parenthesis)

*** Significant at 1% level; ** Significant at 5% level and * Significant at 10% level

[1] The variables are not significant at 10 per cent but significant at 22, 40 and 29.5 per cent level of significance, respectively. Specific effects for South Africa are only significant at 40% but for other countries are not, even at 40%

Table 6.8: Dependent variable - *GPC* (West Africa sample)

Regressors	First Asymptotic (LSDV) Model 4 (West Africa)	Order Results (West	Second Order Asymptotic Results (Bootstrap) No of Replications: 10000	Bias	Confidence Interval LCI	UCI	Level of Significance
LnRGC	-0.0081 (0.0177)		-0.0083	-0.0002	-0.0354	0.0168	Fail to reject the null at 10%
LnRBen	-0.0051 (0.0069)		-0.0051	0.0000	-0.0140	0.0037	Fail to reject the null at 10% [35.6%][1]
INFL	-0.0004* (0.0002)		-0.0004	0.0000	-0.0008	-0.00001	Significant at 4.1%
LnOpen	0.0138 (0.0215)		0.0110	-0.0028	-0.0178	0.0390	Fail to reject the null at 10%
LnSEC	-0.0138 (0.0193)		-0.0138	0.0000	-0.0306	0.0037	Fail to reject the null at 10% [18.7%][1]
LnRinv	0.0402* (0.0240)		0.0404	0.0002	0.0001	0.0819	Significant at 9.7%
Fixed Effects							
BENIN	0.0371 (0.0618)		0.0368	-0.0003	-0.0562	0.0965	Fail to reject the null at 10% [52.4%]
CAMEROON	0.0244 (0.0639)		0.0239	-0.0005	-0.0627	0.0798	Fail to reject the null at 10% [65%]
GHANA	0.0321 (0.0486)		0.0316	-0.0005	-0.0645	0.0929	Fail to reject the null at 10% [60%]
IVORY COST	0.0147 (0.0662)		0.0143	-0.0004	-0.0854	0.0783	Fail to reject the null at 10% [82.2%]
MALI	0.0305 (0.0588)		0.0303	-0.0002	-0.0668	0.0924	Fail to reject the null at 10% [61.6%]
NIGERIA	0.0233 (0.0444)		0.0230	-0.0003	-0.0765	0.0868	Fail to reject the null at 10% [71.7%]
SENEGAL	0.0102 (0.0741)		0.0095	-0.0007	-0.0925	0.0750	Fail to reject the null at 10% [88.8%]

(Standard errors in parenthesis)   * Significant at 10% level   [1] The variables are not significant at 10 per cent but significant at 35.6 and 18.7 per cent level of significance, respectively.

In general, bootstrapping has the advantage of constructing one's own empirical distribution function (or empirical tests), which allows for more accurate levels of

significance with exact probability of committing a Type I error. Figures in annexures 5 and 6 show the distribution of the bootstrapped coefficients based on LSDV coefficients.

6.4 Model for Fertility

In this section the effect of social security on fertility is investigated. Unlike in the case of growth per capita GDP, where empirical results of the effects of social security show adverse results, empirical literature on fertility has consistently shown a negative relationship to social security. In other words, the existence and improvement of social security systems in a society, tend to reduce the importance of children as a means of old age security (Becker and Barro, 1988; Ehrlich and Lui, 1991). However, as argued by Becker, Murphy and Tamura (1990) families with limited human capital tend to have large families and invest little in each member. This is generally the characteristic of developing countries and therefore, their human capital tends to be poor. Becker and Barro (1988) argue that an increase in social security taxes tends to only temporarily reduce fertility, even if the children do not support their parents.

All this supports the ideas that empirical analyses have secularly shown that the existence of social security negatively affects fertility, even if these effects are temporary. Thus, the question is how long it takes before reverting the sign? The answer will surely depend on the dynamics in each specific country or group of countries (given the increase in regional policy coordination through regional blocks of development). Table 7.8 shows the effects of social security on fertility in 14 sub-Saharan African countries (using population growth as a proxy for fertility net of mortality).

The results presented in Table 6.8, column 2 (labelled Model 1), indicate that social security in African countries included in the model does not reduce fertility as argued in the literature for developed countries. Such literature argues that social security reduces fertility and increases investment in human capital (see for example, Ehrlich and Lui, 1998). However, the results in this study have found adverse implications of social security on fertility. These results imply that children receive more weight in the optimal choice of the old age retirement portfolio of the majority of African families than other

forms of retirement do. Therefore, fertility is important to consider when measuring retirement dependency in the typical African family.

This finding, although not statistically significant, is similar to that of the theoretical model by Boldrin, De Nardi and Jones (2005)[35]. The positive relationship between social security and fertility is also in line with the arguments of Becker, Murphy and Tamura (1990) that families with limited resources tend to choose large families and invest less on each family member, which is a characteristic of SSA countries.

However, the results contradict those of Ehrlich and Lui (1998) who find that social security is likely to reduce fertility in the early stage of development and only at a more advanced stage reduces economic growth while little effect on fertility and private savings is expected. The argument put forward in this study is based on the fact that most of the developing countries are consumers of technology developed in advanced western countries. However, due to unequal development and often deficient infrastructure, some technology is used effectively while other is used inadequately, causing confusion. This is important if one intends to analyse the actual structure and/or the performance of the economies of developing countries, in particular those in SSA region in either policy to be considered.

It could be argued that low coverage rates, especially for those families living and working in rural areas cause them to be more vulnerable in old age. For this section of the population a large family weighs more in their old age portfolio than other possible components do. In some other countries with private ownership of land, land bequests are another important motive for having more children - a type of Barro (1974) and Becker and Barro (1988) model where parents are altruistic towards children.

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[35] The authors' general hypothesis is that "since children are perceived by parents as a component of their optimal retirement portfolio, any social or institutional change that affects the economic value of other components of the retirement portfolio will have a first order impact on fertility choices". This implies that general perception of how social security affects the old age portfolio is fundamental for the decision of how many children to have. The result above shows that the majority of the African population has not yet perceived social security as substitute of children in their optimal retirement portfolio.

Table 6.9: Dependent variable - *LnF* (full and regional samples)

Variables	Coefficients (First-order Asymptotic)		
(Regressors)	Model 1 (All Countries)	Model 2 (SADC)	Model 3 (West Africa)
LnRBen	0.0466	0.0969	0.0343
	(0.0383)	(0.0897)	(0.0291)
LnRGC	-0.0475	0.2740	-0.1070*
	(0.0958)	(0.3094)	(0.06380
lnSEC	-0.2559**	-0.3259	-0.0920
	(0.1177)	(0.4198)	(0.0797)
GPC	0.5940	1.0740	0.8034
	(0.5201)	(0.9852)	(0.5248)
RNX	-1.1730***	-1.5701***	-0.6603***
	(0.2577)	(0.5341)	(0.2293)
Fixed Effects			
BENIN	1.7458***		1.1042***
	(0.4843)		(0.2976)
CAMEROON	1.7922***		1.0573***
	(0.5133)		(0.3184)
ETHIOPIA	1.5460***		
	(0.4277)		
GHANA	1.7142***		0.9900***
	(0.5236)		(0.3301)
IVORY COST	1.9937***		1.2522***
	(0.5112)		(0.3172)
KENYA	1.9366***		
	(0.5652)		
LESOTHO	0.5445	1.1520	
	(0.5247)	(1.1520)	
MALI	1.4899***		0.9777***
	(0.3966)		(0.2481)
MOZAMBIQUE	1.1844***	2.2345*	
	(0.4013)	(1.3208)	
NIGERIA	1.9978***		1.2058***
	(0.5109)		(0.3193)
SOUTH AFRICA	1.5066**	2.5100	
	0.5948	(2.0693)	
SENEGAL	2.0868***		1.3345***
	(0.5286)		(0.3372)
ZAMBIA	1.6615***	2.8146	

	(0.5015)	(1.7068)	
ZIMBABWE	1.5306***	2.5104	
	(0.5181)	(1.7970)	

R^2 = 0.6644	R^2 = 0.5089	R^2 = 0.6129
R^2-Adj = 0.6145	R^2-Adj = 0.3984	R^2-Adj = 0.5395
F-stat = 13.3092	F-stat = 4.6061	F-stat = 8.3477
p(F-stat) = 0.0000	p(F-stat) = 0.0003	p(F-stat) = 0.000

(Standard errors in parenthesis)

*** Significant at 1% level; ** Significant at 5% level and * Significant at 10% level

All control variables show interesting results with regard to secondary school enrolment and net exports. Secondary school education has a negative sign and is statistically significant implying that as individuals become more educated, they tend to want fewer children. The reason being that when formally employed they have the opportunity to be integrated into some formal social security systems. This result is important to understand the differences in fertility rates between SSA and developed countries. In most developed countries the level of literacy averages 96 per cent while in many SSA countries the literacy rate average below 54 per cent (HDR, 2006). Literacy plays an important role in the flow of information regarding the role of social security as substitute for children in the optimal retirement portfolio.

An increase in net exports results in an increase in the country's or a household's (particularly a rural one's) income which may reduce the weight of children as a choice of optimal retirement portfolio. Therefore, an increase in net exports will decrease the desire for many children and possibly increase investment in human capital. This variable has a negative sign and is statistically significant at one per cent.

Becker and Barro (1988) argue that an increase in government transfers in an economy tend to reduce fertility. This argument is based on the fact that individuals behave opportunistically (moral hazard) by assuming that government will take care of them in their old age or following a hazardous event that may occur during their lifetimes. The coefficient of government consumption in the model is negative but not statistically significant at the conventional levels. This result implies that government consumption has

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little or no impact on fertility rates in sub-Saharan countries, although it has the desired sign, which may reflect a weakness in government policy in this regard.

Another control variable included in the model is the growth of per capita GDP, which has a positive correlation with fertility but is not statistically significant at the conventional levels. This is in contrast with the results by both the Ehrlich and Kim (2005) and Zhang and Zhang (2004) studies in panel and cross-section analysis. These studies found a negative relationship between growth of per capita income and fertility, which implies that fertility declines with a growth in per capita income. The influences on growth of per capita GDP on fertility in these countries may be even more complex than one would consider. These influences may range from low per capita income to the unequal distribution of income which leaves the majority of the population exposed to only informal (or traditional) social security systems. In this case the growth in per capita income may not be accompanied by a reduction in fertility rates, at least during the early stages of development.

The results, in column 2 (Table 6.8), show that all countries have specific effects that positively influence fertility rates. All these positive fixed effects are statistically significant at one per cent, with the exception of South Africa in whose case the specific factors are significant at only five per cent and Lesotho whose specific factors are not significant at conventional levels.

6.4.1 Testing for the validity of Model 1

Model 1 of this section was estimated using fixed effects Least Square Dummy Variable procedure, allowing for the testing of fixed effects and homogeneity of the coefficients in the model. It is also tested for the validity of exogeneity of variables included in the model.

The test for fixed effects is the test for the validity of the null hypothesis of no individual effects against the alternative that individual effects exists, that is:

$H_O : \mu_1 = \mu_2 = \mu_3 = ... = \mu_{14} = 0$ ➔ No individual effects

$H_A : \mu_1 \neq \mu_2 \neq \mu_3 \neq .... \neq \mu_{14} \neq 0$ ➔ Individual effects exist

The test of fixed effects is an *F-test* and is distributed as an *F-statistic* with [(N-1), (NT-N-K)] degrees of freedom. Where N is the number of cross-sections, T a time dimension and K the number of coefficients estimated. The result of the test is $F_{(13,121)} = 6.5758$ which rejects the null of no individual effects (or common intercept). The results indicate that there are specific factors affecting fertility in SSA countries included in the model.

The next step is to test whether countries have a common slope coefficient, in other words testing for homogeneity of the slope coefficient. This is a test of the null of equality of all coefficients, that is:

$H_O : \delta_1 = \delta_2 = \delta_3 = ... = \delta_{14} = \delta$ ➔ All coefficients are equal and therefore one slope

for all cross-sections

$H_A : \delta_1 \neq \delta_2 \neq \delta_3 \neq .... \neq \delta_{14} \neq \delta$ ➔ Not all coefficients are equal and therefore each cross-section has its own coefficient; in other word coefficients are not poolable.

The test for homogeneity of coefficients is an *F-test* and it is distributed as an *F-statistic* with [(N-1)K, (N(T-K))] degrees of freedom, where N, T and K are read as previously defined. The test rejects the null of poolability of coefficients at the five per cent level of significance in the full sample represented by Model 1.

The Houseman test is used to test for exogeneity of the variables in Model 1, which is distributed as Chi-square with K degrees of Freedom ($\chi^2(K)$). The null hypothesis to be tested is $H_o : E(\varepsilon_{it}/X_{it}) = 0$, which implies exogeneity of the variables in the model or no correlation between individual effects and exogenous variables. The result of the test is $m = 25.7260$, which is greater than the critical value of $\chi^2(5)$ thus rejecting the null

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hypothesis at one per cent level of significance, meaning that not all variables included in the model are exogenous.

The result of the test for serial correlation indicates no evidence of serial correlation. It is based on an LM test distributed as Chi-square with one degree of freedom (χ_1^2) under the null hypothesis of no serial correlation. The result based on the RSS is equal to 5.7916, which is less than the critical value of χ_1^2 thus resulting in the failure to reject the null at one per cent level of significance.

6.4.2 Testing for the validity of the alternative models (regional grouping)

In this section countries were again divided into regional blocks of economic development and/or according to their location based on the reasons provided earlier in the analysis.

The results of the estimation and using LSDV are also presented in Table 6.8. Model 2 (column 3) shows the results of the estimation for the Southern African (SADC) countries. The coefficient of social security is positive but not statistically significant, implying that in the SADC region, although social security is positively related to fertility, its effect is not significantly different from zero. In other words, social security in the SADC countries included in this study has no effect on fertility. This result may be supported by the fact that social security in many countries of the region is only available to a small proportion of the population. Thus, the majority of the populations in this area is still exposed to only traditional social security systems, where children play an important role in the choice of an optimal retirement portfolio.

Two of the four control variables (secondary school enrolment and net exports) have the correct signs. Secondary school enrolment has a negative sign and is not statistically significant at the conventional level. Again the result differs from that of Ehrlich and Kim (2005) who found a positive and significant relationship between fertility and the number of years of schooling. The reason for such a negative relationship could be that the population becomes exposed to formal social security programs.

The specific effects are positive for all countries but not statistically significant at the conventional levels, except for Mozambique which is significant at ten per cent level.

Testing for validity of the null hypothesis of no individual effects against the alternative gives the following result: $F_{(4,40)} = 69.6458$, which rejects the null. Thus, country specific characteristics play an important role in fertility in the countries included in this model to the extent that the countries in the model are not poolable.

No serial correlation has been detected with the calculated LM value equal to 3.2848 distributed as Chi-square with one degree of freedom (χ_1^2). The value of the LM statistic is less than the critical value, resulting in the acceptance of the null of no serial correlation at five per cent.

In Model 3 (column 4), for West African countries, the estimates from LSDV indicate that social security is positively related to fertility, as in the full and SADC samples, and it is not statistically significant.

All control variables contain the expected signs and only government consumption and net exports are significant at ten and one per cent respectively, with the exception of the growth in per capita GDP which has the unexpected sign but which is not statistically significant at the conventional levels. As in the other two regions, fixed effects are positive and statistically significant at one per cent level, indicating that specific factors play a significant role in the behaviour of fertility rates in West African countries. The test for fixed effects of Model 4 rejects the null hypothesis of no individual effects. The result of the *F-test* is $F_{6,58} = 149.7945$ which implies that there are country specific factors affecting fertility in the West African region.

No serial correlation could be detected with LM test equal to 3.9507 distributed as a Chi-square with one degree of freedom (χ_1^2). The calculated LM value is less than the critical value, resulting in acceptance of the null hypothesis of no serial correlation at one per cent level of significance.

6.4.3 Bootstrapping results

Bootstrapping is again used to reduce the size of the distortions relative to alternative methods helping to capture the properties of the data in the hand, which is fundamental in validating the results of the models in assessment.

In this section the results of the regional LSDV models (see 6.3.2) are bootstrapped as performed in previous sections. The results of bootstrapping are presented in tables 6.9 and 6.10 below.

Table 6.9 shows that social security is positively related to fertility in the SADC countries but not statistically significant at conventional levels. However, it is significant at 12.7 per cent, which is much lower than the level of significance given in the LSDV regression. These results show a significant improvement in the power of the test. This result implies that the LSDV results based on assumptions of normality may lead to inappropriate conclusions.

Two of the four control variables have the expected signs. In the case of secondary school enrolment it implies that once people become more educated; children become less weighted in the old age portfolio.

There are significant gains in the power of the test with the bootstrapping and the level of significance of all control variables improved. For example, the government consumption to GDP ratio was significant only at 38.12 per cent with the LSDV estimation, but with bootstrapping the level of significance is 12.7 per cent.

Secondary school enrolment improved from 44.22 per cent to 19.7 per cent (the probability of committing a type I error reduces, that is the probability of rejecting the null while it is true). The results imply that if one is to rely on assumptions of normality the wrong decisions could be taken. For example, the growth in per capita GDP was significant at 28.22 per cent while the true level proves to be at 16.3 per cent.

Table 6.10: Dependent variable - *LnF* (SADC sample)

Regressors	First Order Asymptotic Results (LSDV) Model 2 (SADC)	No of Replications: 10000 Second Order Asymptotic Results (Bootstrap)	Bias	Confidence Interval LCI	UCI	Level of Significance
LnRBen	0.0969 (0.0897)	0.0958	-0.0011	0.00015	0.1882	Fail to reject the null at 10%[12.7%][1]
LnRGC	0.2740 (0.3094)	0.2734	-0.0006	0.00023	0.5581	Fail to reject the null at 10%[12.6%][1]
lnSEC	-0.3259 (0.4198)	-0.3224	0.0035	-0.6428	-0.0002	Fail to reject the null at 10% [19.7%][1]
GPC	1.0740 (0.9852)	1.0729	-0.0011	0.0008	2.1195	Fail to reject the null at 10% [16.3%][1]
RNX	-1.5701*** (0.5341)	-1.5704	-0.0003	-2.4342	-0.7037	Significant at 1%
Fixed Effects						
LESOTHO	1.1520 (1.8279)	1.1337	-0.0183	0.0034	2.2684	Fail to reject the null at 10% [37.8%][2]
MOZAMBIQUE	2.2345 (1.3208)	2.2199	-0.0146	0.0014	4.3221	Fail to reject the null at 10% [11.6%][2]
SOUTH AFRICA	2.5100 (2.0693)	2.4909	-0.0191	0.0093	4.7181	Significant at 6.1%
ZAMBIA	2.8146 (1.7068)	2.7951	-0.0195	0.0056	5.3389	Significant at 2.52%
ZIMBABWE	2.5104 (1.7970)	2.4930	-0.0174	0.0079	4.7640	Significant at 3.20%

(Standard errors in parenthesis)   *** Significant at 1% level

[1] The variables are not significant at 10 per cent but significant at 12.6, 12.7, 16.3 and 19.7 per cent levels of significance, respectively. Specific effects for Mozambique and Lesotho are only significant at 11.6% and 37.8%, respectively.

In Annexure 7 the distribution of 10,000 replications of the bootstrapped coefficient are included based on LSDV regression results. Country specific effects are significant at 2.52, 3.20 and 6.1 per cent for Zambia, Zimbabwe and South Africa, respectively. Country specific effects for Lesotho and Mozambique are only significant at 37.8 and 11.6 per cent, respectively. These results are quite different from the LSDV results. Again if one has to depend on the assumptions of normality it could have been concluded that country

specific effects were not significant except for Mozambique, in which case effects were significant at ten per cent.

Table 6.11: Dependent variable - *LnF* (West Africa sample)

Regressors	First Order Asymptotic Results (LSDV) Model 3 (West Africa)	No of Replications: 10000 Second Order Asymptotic Results (Bootstrap)	Bias	Confidence Interval LCI	UCI	Level of Significance
LnRBen	0.0343 (0.0291)	0.0344		0.0001	0.0683	Fail to reject the null at 10% [28%][1]
LnRGC	-0.1070* (0.06380	-0.1071		-0.2208	-0.0001	Fail to reject the null at 10% [13.8%][1]
lnSEC	-0.0920 (0.0797)	-0.0917		-0.1727	-0.01224	Significant at 1%
GPC	0.8034 (0.5248)	0.8049		0.0003	1.6138	Fail to reject the null at 10% [22.7%][1]
RNX	-0.6603*** (0.2293)	-0.6614		-1.2488	0.1222	Significant at 1%
Fixed Effects						
BENIN	1.1042*** (0.2976)	1.1037		0.4445	1.6787	Significant at 1%
CAMEROON	1.0573*** (0.3184)	1.0570		0.4105	1.6267	Significant at 1%
GHANA	0.9900 (0.3301)	0.9893		0.3328	1.5665	Significant at 1%
IVORY COST	1.2522 (0.3172)	1.2519		0.6018	1.8159	Significant at 1%
MALI	0.9777 (0.2481)	0.9772		0.2443	1.6370	Significant at 1%
NIGERIA	1.2058 (0.3193)	1.2055		0.4727	1.8481	Significant at 1%
SENEGAL	1.3345 (0.3372)	1.3348		0.5270	2.0523	Significant at 1%

(Standard errors in parenthesis)

*** Significant at 1% level and * Significant at 10% level

[1] The variables are not significant at 10 per cent but significant at 28, 13.8 and 18.7 per cent level of significance, respectively.

Table 6.10 contains another result from bootstrapping simulations of the LSDV for West African countries. The results show that social security is positively related to fertility as in the case of the SADC countries and the full sample regressions but not statistically significant at conventional levels. The level of significance given by the second order asymptotic results is 28 per cent against the 24.32 per cent of the first order asymptotic, which shows reduction in the probability of committing type I error.

The control variables results show that only secondary school enrolment and net exports are statistically significant at one per cent levels of significance. All other variables remain statistically insignificant within the conventional levels. Annexure 8 contains the distributions of the bootstrapped coefficients.

The results of fixed effects are all significant at one per cent level after bootstrapping, confirming the results from the LSDV regression.

6.5 Main Insights and Concluding Remarks

In this chapter the empirical effects of social security on saving, growth in per capita GDP and fertility were analysed. The results of the estimation of the saving model (with investment as a proxy for saving) suggest that social security crowds-out saving in the full sample and West African models except for the SADC model, where social security crowds-in saving. However, the coefficients are not significant at the conventional levels of significance. These results suggest that in SADC countries, reforms in social security may be more directed at the development of institutions that mobilise savings for retirement. In other regions, more fundamental reforms will have to be considered. The tests on the results accept fixed effects models in both full and regional samples. No serial correlation and misspecification were detected in the analysis of the saving model. However, the hypothesis of poolability of cross-sections in these models was rejected thereby justifying the estimation of fixed effects models, as outlined.

In the second section, per capita GDP growth was estimated and the results indicate that social security negatively affects growth in per capita GDP. This was found in the full sample, SADC and West Africa models in both LSDV and least square pooled models.

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These results are not statistically significant at the conventional levels for all models considered (full sample and regional grouping). The results also suggest that the role of social security in the performance of the economy is still undervalued. Therefore, policies that emphasise the important role of social security in the performance of these economies are necessary. In both LSDV and pooled least square models, no serial correlation and misspecification were detected but the poolability of both coefficient and fixed effects, were accepted. In this case the ideal would have been to estimate individual (country) regressions but the lack of long time-series data prevented such an exercise.

In the third section the LSDV model of fertility was estimated with the social security coefficient positive and not statistically significant at the conventional levels. The results suggest that lower weights are allocated to social security in the optimal retirement portfolio of the majority of African families compared to components like children, as provision for retirement. No misspecification and serial correlation were detected and the poolability of both coefficients and cross-sections was rejected thereby validating the estimated models. An important result in this model is that as they receive more education, individuals tend to attach less weight to children in their retirement portfolio. The reason being that the probability of being involved in some formal social security system increases and therefore, children as a means of old age security, are no longer the only option.

Bootstrapping was performed and it confirmed the results in all estimated models. The advantage of bootstrapping is that it improved the level of confidence of the models assessed since their validation is based on the data available. Various authors recommend the use of bootstrapping in small panel data rather than depending on the asymptotic normality assumptions, which may not hold in small sample data. This is confirmed in this study given the fact that the majority of the results obtained could have led to wrong conclusions. An example of this is: concluding that a coefficient is significant at a certain level of significance while it is actually not: for example, the variable secondary school enrolment for the West African region in the fertility regression was significant even at 10 per cent, but after bootstrapping it became significant at one per cent level.

Chapter 7: Conclusions and Policy Implications

7.1 Introduction

In Chapter 1 the hypotheses to be tested in this study were outlined as follows:

In sub-Saharan African (SSA) countries:

1. the availability and level of retirement benefits reduce saving,
2. retirement benefits contribute towards economic growth, and
3. the level and availability of retirement benefits correlate negatively with fertility.

By testing these hypotheses, the objectives were stated as an effort to identify factors that may affect the performance of retirement programs and also to raise awareness with policymakers in SSA countries regarding the impact that such retirement programs may have on the alleviation of poverty in their countries. As outlined in the previous chapters, the results turned out to be contradictory. For example, retirement benefits crowd-out saving in some regions (West Africa), while they crowd-in saving in other regions (SADC). In the per capita growth regressions, social security negatively affects per capita growth in both regions, except when all countries are pooled together (see Table 6.5).

However, this is in contradiction to the general hypothesis based on empirical and theoretical studies, that social security is positively related to per capita growth. The latter correlation is based on the fact that social security contributes to higher levels of saving, which can be translated into productive investment which in turn increases the level of output. Furthermore, the results show that social security correlates positively with fertility in all regions. This result also contradicts what was reported in a number of empirical studies discussed in Chapter 2. In the latter discussion the availability of social security programs for the elderly on the premises that poverty risk is diminished through the availability of retirement programs negatively correlated with fertility and the planned number of children decreased accordingly.

Therefore, the outcome of this study should serve as a stern warning to governments in Africa that the structure and efficiency of retirement programs should receive urgent attention, especially in view of the African Union (AU) objectives of halving poverty by 2015. Starting with the micro and macro effects of retirement programs the role these programs play in terms of saving and growth is especially disconcerting.

This chapter is structured as follows: Section 7.2 presents an overview of the effectiveness of current social security systems affecting retirement, including regulatory arrangements and their impact on economic performance and on fertility. Section 7.2.4 outlines the limitations of the study and provides some direction for future studies on this topic.

7.2 An Overview of the Effectiveness of Current Social Security Systems on the Economies of SSA Countries

This section presents the main conclusions emerging from this study regarding the effects of social security on the performance of the economies of SSA countries. The section starts by discussing the regulatory arrangements, followed by the impact of social security on the economy and fertility.

7.2.1 Regulatory arrangements

The regulatory systems of existing social security programs in the majority of sub-Saharan countries seem to be outdated and require urgent and thorough reconsideration to ensure that retirement systems support the objectives of reducing poverty among the elderly.

As part of retirement system reforms, replacement and coverage rates should receive special attention especially in view of the growing informal sector in these countries. Replacement rates are low in the majority of SSA countries and even where data is available such rates are difficult to calculate accurately given the many country unique differences that have to be accommodated. For example (see Annexure 2), in Benin regulation determines that only 20 per cent of the average monthly earnings during the last

10 years, plus an increment of 2 per cent for every year of insurance coverage beyond 15 years, be paid as a benefit to a retiree.

In the case of Zimbabwe, only 3 per cent of monthly insurable earnings multiplied by the number of years of contributions up to 30 years are payable to a retiree. An additional 2.25 per cent of monthly insurable earnings multiplied by the number of years of contributions over 30 years, are also payable. However, in some other countries, social security benefit payments are simply too generous, with replacement rates in excess of 60 per cent. For example (Annexure 2), in Congo (Brazzaville) and Chad, the maximum replacement rate payable to a retiree is 80 per cent with 60 per cent of the national minimum wage set as a minimum benefit payment. In addition, such low replacement rates are complicated by the fact that the majority of SSA countries do not adjust benefit payments to the cost-of-living.

When considering public-sector employee retirement schemes as well as relevant private enterprises, coverage rates are exceptionally low. This could be mainly attributed to the fact that large numbers of people reside in rural areas and are therefore not formally employed. Considering that SSA economies basically depend on agriculture and the informal sector (including domestic workers) the present legislation in SSA countries excludes the majority of the population from retirement programs. However, some countries allow for a more comprehensive coverage, although not sufficient. For example, Senegal and Sierra Leone allow voluntary contribution to social security for self-employed individuals. In the case of Benin all individuals are required to contribute to social security with additional voluntary contributions to provident funds allowed for citizens working abroad. Other countries simply exclude all these categories and consider only those formally employed. Therefore, for the rate of coverage to improve retirement systems in SSA countries should urgently be reformed, but not necessarily through privatisation.

Annexure 1 shows that retirement schemes in most countries are being administered by the respective governments. Thus, from an efficiency point of view it seems as if government managed social security systems provide the best option in Africa at this stage of its economic and political development (emergence of new democracies). Moreover, it seems that due to high transaction costs (including administrative expenses, marketing and advertisement) scale economies are better captured under government managed schemes

as opposed to those managed privately. Therefore, the reforms should primarily be considered within the structure of government management through the introduction of a performance principal-agent management model as discussed in Chapter 3.

Such redesigning of retirement schemes should be targeting regional integration with scale economies to be captured both at country and regional levels. This implies that the number of operators in the industry can be more efficiently managed, avoiding excessive costs relating to the marketing and administration of the funds.

Depending on country or region specifications, such reforms should be done in phases, with some countries or regions reforming faster than others. These reforms could be initiated by setting the necessary institutional arrangements for future transformation into more competitive social security systems and considering the updating of existing legislation (described in Annexures 1 and 2). In the majority of cases, legislation was designed during 1960s through 1970s and the economic and political environments since then have changed so radically that this legislation is no longer relevant.

The growth of the informal sector is a major example of such changes in the economic environment. This sector needs to be taken into account when African governments make decisions regarding retirement programs. The informal sector is prospering in the majority of SSA countries and it involves billions of domestic and foreign currencies, which need to be mobilised into formal institutions. One way of convincing those in the informal sector to channel their proceeds into the formal sector is by setting up credible institutions (with comprehensive rules regarding the benefits an individual will be entitled to during his or her retirement). Individual accounts, as proposed by the World Bank and others seem to be viable option since it could serve as a saving account to which after reaching a certain age determined by law, retirement contributions could be made on a regular basis.

Another limitation that results from the current legislative constraint is the free movement of benefits within the region, in other words, a retiree should be allowed to receive his or her benefit in another country in the region. The Charter (2003) on social security in the SADC region constitutes a good example of the kind of arrangement that a region could start towards a more integrated social security system. Therefore, considering the

heterogeneity within the region, countries in the same region should reduce the differences in their social security regulatory systems to a minimum.

While consolidating the management of these systems, more fundamental reforms should gradually be introduced, for example, liberalisation of the sector and investment in training expertise in the insurance and life industries that is capable of properly managing such funds. As part of the retirement reforms the integration of retirement programs within the overall strategies of poverty alleviation currently on course in many sub-Saharan countries should be considered. This emerges from the fact that legislation in the majority of retirement programs as analysed in Chapter 3 (see Annexure 2) allows for dependents of the member of a retirement scheme to benefit from contributions made during his or her working career.

In general, policymakers in SSA countries have to prioritise the efficiency and effectiveness of their retirement systems by initiating institutional changes that could accommodate the necessary changes in retirement programs. Given the relatively low level of economic development in many of the countries investigated, governments will have to initiate the reform programs. In the absence in most cases of private initiatives, government should also take long term responsibility for the administration of retirement programs. What is suggested is the introduction of a performance principal-agent management model with strong regulation and monitoring to ensure sound management principles. During the reforms replacement and coverage rates should be reconsidered. The growing informal sector especially needs to be considered and an increase in such rates will improve the standard of living of the elderly and their dependants, especially in rural areas. Different variations of social security (including retirement) are operational in the informal sector and it may be a useful exercise to investigate their potential in terms of supplementing the current systems. However, reform of the existing retirement systems should be featured by a step-wise approach considering the unique country characteristics in the region. No standard solution will be able to cater for all the countries investigated.

7.2.2 The impact of social security systems on saving and economic growth in SSA economies

The impact of social security on the performance of economies has been widely discussed in the literature, especially after the publication of a World Bank Report (1994) on this matter. However, despite the vast literature on the topic, no conclusive results have yet been produced with regard to what the ideal structure and functional operation of retirement programs should be to optimise economic growth and stability. There seems to be consensus though that social security financed by means of a PAYG system has devastating intergenerational transfer effects. As a result, the World Bank proposed a shift from this type of retirement scheme to a multi-pillar one. The main objective of such a shift is to reduce the implicit deficit borne by governments in the course of providing for retirement benefits. Given the fact that the majority of SSA countries are already highly indebted, retirement reform with increased benefits may be impossible especially if benefit payments are adjusted to the cost-of-living (see Table 7.1)

In fact, the way in which countries reform their retirement systems will impact on their economies differently depending on the level of replacement. If replacement is inflation adjusted (CPI or cost-of-living)[36], the impact on the economy may be worse than when the adjustment is based on the average annual growth rate in wages (Table 7.1).

The reason is because generally the inflation rates of the majority of SSA countries tend to be higher than the growth rates of productivity. Therefore, adjustments based on CPI would imply that SSA countries pay retirement benefits that are in excess of labour productivity. A solution may be to use a weighted average of CPI and the average annual growth rate in productivity of each sector. This will help to smooth both the effects of low productivity and high inflation. For example, a country like Benin will tend to have a high benefit to GDP ratio with adjustment of benefit payments based on CPI compared to the Ivory Coast with adjustment based on the average annual growth rate in wages (Figure

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[36] The lack of data on debt contracted to finance social security prevent a more detailed and complete analysis related to this matter.

7.1, see also Figure 1 and 2 in Chapter 1), and, therefore, their budgets will be affected differently.

In addition the negative effect of inflation, the budgetary implication of retirement reforms largely depends on the number of retirees entering the systems. In a high inflation scenario retirees are worse off with the cost of living impacting negatively on their capacity to consume and maintain their standard of living. In general, countries with higher inflation tend to under perform economically, but are featured by relatively high benefit/GDP ratios (see Table 7.1 for the case of Nigeria and Zimbabwe). This phenomenon seems to confirm the results of the growth model in Chapter 6, where the inflation variable correlates negatively with per capita growth in SSA countries. Table 7.1 indicates that in the cases where countries adjust retirement benefits according to the cost-of-living, their debt/GDP ratios tend to be much higher than in the cases where benefits are left unadjusted or linked to increased productivity. In the longer term the problem of having to constantly adjust to the rising cost of living seems to be increasing.

Table 7.4: Comparing the government debt performance given replacement rates

Country	Replacement rates	Adjust/ to cost-of-living	Average inflation rate	Average growth rate	Average benefit/ GDP ratio	Expected effect on gov. debt	Country
	Min	Max					
Benin	60% of minimum wage	60% of average monthly earnings	Inflation or cost-of-living	7.97%	5.18%	0.27%	Higher
Cameroon	50% of legal minimum wage	80% of average monthly earnings	No	7.53%	4.76%	0.09%	Depends on new retirees entering the system
Ghana	50% of annual salary in the best 3 years of earnings, plus 1.5% for each 12 months		No	30.1%	3.14%	0.34%	Depends on new retirees entering the system
Ivory Coast	Depends on average earning over the worker's carrier		Annual change in average salary subject to contribution	6.77%	3.10%	0.12%	Lower
Nigeria	80% of minimum national wage	65% of average monthly contribution	No	22.91%	2.37%	1.71%	Depends on new retirees entering the system
Zimbabwe	I based on number of years of contributions		No	115.19%	-4.06%	3.38%	Depends on new retirees entering the system

The results obtained using the LSDV method of estimation show that social security crowds-out saving in the fourteen SSA countries, which confirms the hypothesis stated at the beginning of the research. These findings are in agreement with those in the literature (see Section 2.2 in Chapter 2).

Bootstrapping is used to confirm the LSDV results, which is recommended as a means to improve the level of significance of the coefficients of variables included in the model under investigation. This methodology has been widely employed in most recent studies to validate the results of estimations, especially in small samples. At the regional level the results of the effect of social security on saving are mixed. For SADC countries social security crowds-in saving while in the West African countries social security crowds-out savings.

The difference in the results may be due to the differences in structure, stability, macroeconomic and microeconomic conditions of countries in each region. These factors determine the economic policies adopted in every country and hence differences in the effect of social security programs. For SADC countries, where saving is not crowded out by retirement benefits paid, reforms should be focussed on strengthening the financial markets and finding ways in which contributions to retirement programs could be utilised more effectively in order to supplement current savings. In the case of West African countries, reforms will have to be more fundamental, starting with improvement in the management of schemes that currently exist. Only then will it be possible to restructure the financial markets to provide for the kind of financial instruments required by retirement funds and channelling such funds into the macro economy. Through a more diversified portfolio the return on retirement funds will be sufficient to compensate for the loss in income after retirement.

The results seem to implicate that regional integration (development blocks) will be conducive to reforms of the retirement industry with proper policy co-ordination that limits the level of instability both politically and economically. Chapter 3 (Section 3.4) explains the way in which uncertainty may inhibit the potential of retirement funds to impact positively on per capita income and therefore growth. In this regard Africa is unique with many exogenous factors like droughts, floods, and wars that have to be

discounted in the risk profile of these countries. The underdevelopment of financial markets will first have to be addressed together with these factors before retirement programs could have a positive effect on economic growth and saving in particular, as suggested in the literature. By using bootstrapping techniques the LSDV regression results improved with more significant coefficients compared to those of the first order asymptotic model. This confirms the rejection of the hypothesis that social security contributes to economic growth in SSA countries.

Theoretically the funding of social security programs, whether through taxes or the issuing of debt does not seem to alter the impact of such programs on the economy's performance. In an intergenerational context, the introduction and funding of retirement programs would affect the economy positively when the economy is growing at a steady rate with the growth rate of the population and wages equal to that of the economy. Should the economy depart from this steady state position, future generations will be affected negatively due to the lack of saving of present generations.

In the context of SSA countries, such a steady state seems to be a pipe dream. In view of the weaknesses of traditional family structures where wages are highly volatile and future uncertainty and other social demise cause the population numbers to increase far more than the growth in income. The savings pool is highly dependent on foreign savings and donor funds, given the already indebted economies. Most SSA countries are not in a position to fund retirement through the issuing of debt. Due to the narrow tax base, payroll taxes also offer limited opportunity to fund retirement benefits and instead, inhibit economic growth through their crowding out of discretionary savings. Increased levels of debt slow the economic growth rate down and increase the risk factor through intensified social conflicts.

The fact that only a few SSA countries thus far have implemented provident funds as an alternative to traditional pension funds, may also affect the way in which social security impacts on the economies of these countries. The fact is that benefits from provident funds tend to exceed those of the conventional retirement schemes. The reason being that investment portfolios of the latter schemes, generally managed by government, tend to differ from those of provident funds. Such differences in the effects of social security

schemes are at the heart of the controversy reported earlier between the supporters of the World Bank (1994) views like James (1996) and those opposing it like Orzig and Stiglitz (1999).

The results discussed here suggest that countries in SSA are expected to reconsider their regulatory systems and the structure of replacement rates, coverage and adjustment based on living costs. However, this is a dilemma for the majority of SSA countries with low and unstable per capita growth rates (see Figure 2 in Chapter 1). Government budgets in the majority of these countries are highly dependent on donor funding which are in most instances accompanied by conditions regarding the use of the money. Such effects could be worse in countries were government is the major employer and contributions from employees are not deducted from their wages for the purpose of retirement[37]. In such cases the entire burden is borne by the government and the implicit debt in order to pay for retirement benefits accumulates to such an extent that it impacts negatively on economic growth. Obviously the outcome of such a debt-financed retirement program will largely depend on the way in which the debt is financed.

7.2.3 The impact of social security systems on fertility

In the model where the impact of social security programs on fertility is analysed, the results show a positive correlation, thereby rejecting the hypothesis that social security contributes to a reduction in fertility rates in SSA countries. This result seems to imply that current retirement programs are not yet perceived as a substitute for children to providing for income during retirement. However, despite the fact that social security correlates positively with fertility, fertility rates correlate negatively with the number of years of schooling. This result is significant and in line with modern thought on this issue. The reason being that as individuals become more educated the possibility of being involved in formal retirement programs increases. This leads to a reduction in the number of children and consequently investment in human capital increases. Human capital in turn

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[37] Some countries have dual contribution systems like Mauritius, and others like Botswana government simply take the responsibility of financing the full expenditure of their retirees. No contribution is required from employees to finance retirement putting heavy burden to the government budget for social programs.

plays an important role in the structure and performance of the economy which determines the income and revenue base from which retirement contributions can be sourced.

Thus, retirement reforms also implicate improved educational structures with better quality education that would enhance skills and enable people to become part of the economically active population with a steady income. Such investment in education should also be accompanied by increased levels of coverage, mainly in the rural areas and the informal sector. In such a reformed environment the expected negative correlation between retirement benefits paid and fertility would realise with a concomitant impact on economic growth and stability.

7.2.4 Some specific recommendations for reform in the retirement industry

In the discussion thus far there has been much reference of the role and impact of the informal sector. The majority of individuals are involved in informal economic activities and their capability to contribute towards some kind of retirement program largely depends on the possibility of accommodating them within the financial infrastructure of an economy. The design of institutions that deal with the informal sector may take the form of a national saving fund that operates like a bank, but with a clear mandatory objective of collecting long-term saving for retirement. Such saving institutions could be managed by means of a principal-agent model within a properly structured regulatory environment to ensure that the savings collected are administered safely and efficiently.

The way such saving institutions are devised will vary from country to country, depending on the country specific conditions. For example, it could be implemented through a few pilot projects in selected areas that could serve as a template for the rest of the country. However, given the nature and financial capacity of the individuals to be covered by the program, government has to back them up in its initial phase by supporting part of the administrative costs and raising awareness through a national program.

Moreover, in this initial phase, based on local available capacity and conditions, the new saving institutions may use facilities of already existing government or public enterprises such as, for example, post offices.

The use of post offices for collecting savings in rural areas can work quite and was proven in Mozambique before the country was interrupted by civil war. In South Africa, the Mzanzi project for low income saving is an attempt to cater for the poor that cannot access the formal banking systems due to the relatively high transaction costs involved. It differs from the model proposed here, in that savings are meant to be long-term, with clear and rigid rules when withdrawals are possible and who is entitled to the savings in the case of death of the contributing member.

The value of the benefit at retirement could then be calculated on the basis of contributions made and interest accrued by actual retirement. In this system members need not contribute on a regular basis (e.g. a fixed monthly amount) since in many instances income is volatile. However, a minimum contribution seems to be reasonable in order to cover the financial institution's service fees. A daunting feature of this model is the fact that benefit payments differ based on contributions and not some "minimum" determined in retirement legislation such as the old age pension scheme in South Africa. This proposal is also in line with that of the World Bank. The notion is that individuals would be encouraged to contribute more in order to enjoy a reasonable standard of living when retired.

A second recommendation is to broaden the scope of financial markets of the countries involved, to provide the type of financial instruments that would offer more lucrative returns to retirement investment. In many instances the problem seems to be outdated regulatory frameworks and capacity to be able to manage such a restructuring of current institutions. In many cases it would mean fundamental monetary reform which, in a globalised world seems to be unavoidable

7.2.5 Limitation and future research

A major limitation of the research results in this study is the substantial diversity in the structure and performance of the countries included. In addition the high level of political instability in some countries obscures the economic impact of retirement programs. The catastrophic impact of such instability on growth potential and on standards of living will necessarily handicap the economy. Thus in an analysis of this nature with pooled data from the countries included in the model it is extremely difficult to generalise when it comes to the application of policies. However, the lack of reliable data and the long lags in publishing the latest data limited one's choices to only that used in the models.

Also the fiscal impact of retirement benefits is difficult to estimate given the lack of data on the way in which current benefit payments are financed. Since most of the countries are highly indebted, it can be assumed that a large percentage of benefits paid are financed through debt, but it could also be through donor funding or taxes. As we simply do not know, this causes a problem in the analysis as the economic impact of each of these would be quite different.

This difficulty will have to be bridged in future research on this topic. In order to do that data will have to be that much more detailed. Another major shortcoming in this study must be addressed, is the role of private saving institutions in terms of retirement funding. Although it seems as if retirement and social security in general are mainly a government responsibility, the privatisation thereof should be investigated. A country like South Africa, has taken some interesting initiatives in this regard that could be investigated as a model for the rest if Africa, and specifically, West Africa where the problem seems to be worse.

A further problem is the general role that corruption and bad governance play in terms of the successful management of retirement programs. This problem has to be investigated through proper cost benefit analyses from other studies on governance in Africa, so that it can be resolved and management become effective.

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Annexures

List of Countries included in the this study

01. Benin
02. Cameron
03. Ethiopia
04. Ghana
05. Ivory Coast
06. Kenya
07. Lesotho
08. Mali
09. Mozambique
10. Nigeria
11. Senegal
12. South Africa
13. Zambia
14. Zimbabwe

Country	Type of social security system: Type of Regulation	Year (first regulation)	Coverage
Mauritius	Dual: 1. non-contributory and 2. social insurance system.	First law: 1951 Current law: 1976 (national pension) with amendments.	Basic pension (non-contributory): All resident aged 60 or older. Earnings-related pension (contributory): All employees older than age 18. Voluntary affiliation under the earnings-related program for those not covered compulsorily, including the self-employed and non-employed persons. Special system for public-sector employees and certain occupations with equivalent private programs.
Nigeria	Social insurance system	First law: 1961 (provident fund). Current law: 1993 (social insurance), implemented in July 1994.	Employees of firms with 5 or more workers. Exclusions: Civil servants, diplomats, non-citizens covered by an equivalent program in another country, self-employed persons, and clergy. Voluntary coverage for some excluded categories of worker under specified conditions. Special system for pensionable public-sector employees.
Senegal	Social insurance system	First and current law: 1975 (convention of the 1958 non-statutory program)	Employed persons, including domestic workers, seasonal workers, and day workers. Special system for civil servants.
Sierra Leone	Social insurance system	First and current law: 2001 (social security and national insurance), implemented in 2002.	All employees in the public and private sectors. The self-employed can be covered on a voluntary basis.
Ghana	Social insurance system	First law: 1965 Current law: 1991 (social security).	Employed persons Voluntary affiliation for self-employed; non-employed formerly insured persons may contribute voluntarily as if self-employed. Special system for members of the armed force.
Tanzania	Separate provident fund and Social insurance system	First law: 1964 (provident fund). Current laws: 1975 (provident fund) and 1978 (parastatal pensions), with 2001 amendment.	Provident fund: Employees in the public and private sectors. Exclusion: Domestic employees. Social insurance: All employees from parastatal organisations, government agencies, private companies, and self-employed pensions including informal workers.
		First law: 1965 (provident fund).	Employed person, Including agricultural workers, domestic servants in urban areas, apprentices, and all employees who joined the public service and local authorities on or after February 1, 2000. Exclusions: Workers under age 15 or older than age

Zambia	Social insurance system	Current law: 1996 (pension scheme)	55, as well as those earning less than k15, 000. Voluntary affiliation for the self-employed and other categories of worker in the informal sector. Special system for public-sector and local government employees who joined before February 1, 2000.
Zimbabwe	Social insurance system	First law: 1993 Current law: 1995, 1998, 2001, 2002, and 2003.	Compulsory coverage for all employed persons between ages 16 and 65 who are citizens or resident of Zimbabwe. **Note:** Universal coverage to be achieved in phases. The first completed phase provided coverage to employees in all sectors with the exception of domestic workers and civil servants. The second completed phase provided coverage to civil servants. The third phase will cover domestic workers, and the fourth phase will cover self-employed workers and informal sector employees.
Sao Tome and Principe	Social insurance system	First and current laws: 1979 and 1990 (social security).	Employed persons. Exclusions: Domestic workers Voluntary program for the self-employed.
Botswana	Universal old-age pension program	First and current law: 1996.	All citizens of Botswana aged 65 or older. Special system for public-sector employees.
South Africa	Social insurance system	First laws: 1928 (old-age), 1936 (Blindness), and 1946 (disability). Current law: 1992 (social assistance), with amendments.	Citizens of limited means Special system for public-sector employees.
Swaziland	Provident fund system	First and current law: 1974.	Employed persons. Exclusions: casual employees, domestic servants, and non-citizens. Special system for public-sector employees.
Seychelles	Social insurance system	First laws: 1971 (provident fund); abolished in 1978 and replaced in 1979 (social security fund) . Current laws: 1987 (social security fund) and 1990 (Seychelles pension scheme supplements the social security fund)	Social security fund: Employed persons, the self-employed, non-employed persons with unearned income, and public-sector employees. Seychelles pension scheme: All full-time workers (25 hours a week or more); the self-employed, part-time workers, and the unemployed may join voluntary.
Burkina Faso	Social insurance system	First law: 1960 Current law: 1972	Employed persons, technical students, and apprentices. Voluntary insurance is available to self-employed persons who were previously covered as employed persons. Exclusions: Temporary workers; temporary

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			employed aliens covered in another country. Special system for public-sector employees.
Cameroon	Social insurance system	First law: 1969 Current laws: 1984 and 1990.	Employed persons. Voluntary coverage is available for non-covered workers (not yet implemented). Special system for civil servants.
Central African Republic	Social insurance system	First law: 1963 Current law: 1981	Employed persons, including government officials, members of public groups (if not otherwise covered), students in professional schools, trainees and apprentices (even if non-salaried), members of religious orders, and domestic workers.
DR Congo	Social insurance system	First law: 1956. Current law: 1961 (1988 social security code, not implemented).	Employed persons, including domestic workers, casual workers, and some categories of boat workers. Voluntary coverage for non-employed persons who have at least 5 years of covered employment and who request to be covered within the 6-month period after the cessation of paid employment. Special system for public-sector employees.
Ivory Cost	Social insurance system	First law: 1960 Current laws: 1968, 1971, 1988, and 1999.	Salaried workers in all sectors. Special system for civil servants
Kenya	Provident fund system	First and current law: 1965.	Employed persons Exclusion: Casual workers Special pension system for public-sector employees
Benin	Social insurance system	First law: 1970 Current law: 2003	Employed persons Special system for public-sector employees Special system for informal economy workers Voluntary provident fund for citizens working abroad.
Chad	Social insurance system	First and current law: 1977, implemented in 1984.	Salaried workers regulated by the labour code
Ethiopia	Social insurance system	First and current laws: 1963 (public employees) and 1975 (employees of government owned enterprises)	Public-sector employees and employees of government-owned enterprises
Congo (Brazzaville)	Social insurance system	First law: 1962 Current law: 1986	Employed persons
Gabon	Social insurance system	First law: 1963 Current law: 1975	Employed persons Separate system for self-employed and state workers under contract Special system for public employees
Guinea	Social insurance system	First law: 1958 Current law: 1994	Employed persons

Source: www.socialsecurity.gov

Annexure 2: The Source of Retirement Funds and Qualifying Conditions for Benefit Payments

Country	Source of Retirement Funds		Qualifying Conditions		
	Employee	Employer	Retirement Age	Benefit	
				Worker (Insured person)	Survivor/Orphans
Zambia	5% of earnings	5% of payroll; **Government**: None; Maximum earnings for contribution purposes are 4 times national average earnings. Both employee and employer contributions finance funeral grants	**Old-age pension**: 55 with at least 180 months contributions and retired from regular employment. **Survivor pension**: the death of an insured person with at least 5 years contributions or who was receiving the old-age pension or disability pension **Lump-sum benefit**: for those who do not meet the eligibility criteria for pension	**Old-age pension**: A monthly pension equal to the insured's average indexed monthly earnings times the accrual rate and multiplied by the number of the contributions; **Lump-sum benefit (old-age)**: the total insured employee and employer contributions plus accrued interest	**Survivor pension**: If the insured was employed at the time of death, the pension is equal to the compensation for lost work-years plus the greater of the monthly calculated pension or a minimum pension. If the insured was receiving an old-age or disability pension, the pension is converted to a survivor pension. The pension is payable to the spouse or dependent children up to age 18; 25 if in full-time education; **Funeral grant**: Equal to 10 times the minimum pension, payable to the survivor; **Lump-sum benefit (survivor)**: The total indexed employee and employer contributions plus accrued interest
	3 per cent of earnings	3 per cent of payroll **Government**: None; The maximum	**Old-age pension**: 60 (age55 for arduous employment) with at least 10 years of contributions. If aged 49 or older as of October 1994, up to 7 years of contributions may be	**Old-age pension**: 3 per cent of monthly insurable earnings multiplied by the number of years of contributions up to 30 years, plus an additional 2.25 per cent of monthly insurable earnings multiplied by the number	**Survivor pension**: 3 per cent of monthly insurable earnings multiplied by the number of years of contributions up to 30 years, plus an additional

Zimbabwe		monthly earnings for contribution purposes are Z$8,000	credited. **Deferred retirement**: Up to age 65. **Retirement grant**: The insured person has between one and ten years of contributions. **Survivor benefit**: The insured was receiving, or met the qualifying conditions for, the old-age pension or disability pension at the time of death and had not reached retirement age **Survivor grant**: The insured met the qualifying conditions for the retirement grant or disability.	of years of contributions over 30 years. **Retirement grant**: A lump sum equal to 1/12 of annual insurable earnings times the number of years of contributions up to 10 years.	2.25 per cent of yearly insurable earnings multiplied by the number of years over 30 years. **Survivor grant**: A lump sum of 40 per cent of the insured's entitlement to a retirement or disability grant for a widow(er); 40 per cent for children until age 18 (age 25 if student); 12 per cent for parents; 8 per cent for other eligible dependents. **Funeral grant**: A lump sum of Z$4,500. The insured person must have contributed for a minimum of one year.
Sao Tome and Principe	4 per cent of earnings	6 per cent of payroll; **Government**: None	**Old-age pension**: 62 (men) and 57 (women) with 120 months of contribution. Retirement is not necessary. **Survivor pension**: The insured was a pensioner or eligible for a pension at the time of death, with at least 60 months of recorded earnings.	**Old-age pension**: 35 per cent of average earnings in the best 5 years out of the last calendar years, plus one per cent for each year of coverage up to 25 years and 2 per cent for each year of coverage beyond 25. **Deferred pension**: The pension is increased by 3 per cent for each year of coverage after the normal retirement age. Minimum pension is 30 per cent of the national minimum wage. **Benefit adjustment**: Benefits are indexed to wage increases.	**Survivor pension**: 60 per cent of the insured's pension is paid for one dependent, 80 per cent for two, and 100 per cent for three or more. The pension is payable to a widow(er), children under age 18 (no limit is disabled) and dependent parents. **Funeral grant**: A lump sum equal to the cost of funeral.
Botswana	None	None; **Government**: Total	**Old-age pension**: 65 and resident	**Old-age pension**: A flat-rate monthly pension of 151 pula.	

			cost.		
South Africa	None (means-tested) 7.5 per cent (statutory)	None (Means-tested) 15 per cent (Statutory) *Government*: Total cost (Means-tested)	*Old-age pension (Means-tested)*: 65 (men) and 60 (women) and a resident citizen at the time of application. *War veteran grant (Means-tested)*: 60 or disabled and a resident citizen at the time of the application. Eligibility is restricted to veterans of the Second World War and Korean War.	*Old-age pension (Means-tested)*: Up to 640 rand a month (married couples may receive double the amount) plus 130 rand a month for frail and chronically ill pensioners requiring full time care. *War veteran grant (Means-tested)*: up to 658 rand a month plus 130 rand a month for frail and chronically ill veterans requiring full-time care	
Swaziland	5 per cent of earnings	5 per cent of payroll; *Government*: None. A ceiling is placed on the maximum monthly earnings for contribution and benefit purposes	*Old-age pension*: 50; 45 and retired from regular salaried employment, or any age if emigrating permanently *Survivor pension*: The death of the fund member prior to retirement. There is provision for reciprocal agreements with other countries operating a provident fund.	*Old-age benefit*: Total employee and employer contributions, plus at least 3 per cent interest rate per year. The benefit may be paid as lump sum or converted to an annuity providing periodic payments.	*Survivor benefit*: Total employee and employer contributions, plus at least 3 per cent of interest per year. The benefit may be paid as a lump sum or converted to an annuity providing periodic payments. The benefit is payable to widow, other dependents, or other persons designated by the fund member.
	Social security fund: 5 per cent of earnings; the self-employed contribute through the tax	*Social security fund*: 10 per cent on the first Rs1,000 of monthly wages, 20 per cent on second Rs1,000, 35 per cent on the next Rs8,000, and 40 per	*Social security fund*: 63 with 5 years of residence immediately preceding the date of retirement. (The residence requirement may be waived by the Minister of Finance under special circumstances.)	*Old-age pension (social security fund):* Rs1, 100 a month. Benefit adjustment: Benefits are reviewed and adjusted each year for cost-of-living changes. *Old-age pension (Seychelles pension*	*Survivor pension (social security fund):* Rs825 a month for one year if the widow is aged 45 or older or has a dependent child under 15 (over age

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Seychelles	system. ***Seychelles pension scheme***: voluntary contributions of at least 10 rupees; there is no maximum contribution	cent on wages in excess of Rs10,000 ***Seychelles pension scheme***: Rs50 a month for each full-time employee. ***Government***: None	***Seychelles pension scheme***: 63 with 5 years of residence immediately preceding the date of retirement. (The residence requirement may be waived by the Minister of Finance under special circumstances.) ***Survivor pension*** ***Social security fund***: Five years of residence. ***Seychelles pension scheme***: Five years of residence.	***Scheme):*** Benefits are based on the value of the insured's voluntary contributions. ***Funeral grant***: Rs1, 500. If death occurs before retirement, a lump sum equal to 50 per cent of the compulsory contributions paid to the social security fund and 100 per cent of voluntary contributions paid to the Seychelles pension scheme. If death occurs after retirement, the grant equals the old-age pension.	15 if student). The pension is also payable to a dependent widower ***Orphan's pension***: Rs500 a month
Burkina Faso	4.5 per cent of earnings	4.5 per cent of payroll; ***Government***: None. The maximum monthly earnings for contribution and benefit purposes are 200,000 CFA francs.	***Old-age pension***: 55 (age 50 if prematurely aged or 53 if civil servant) with 180 months of coverage. Retirement from gainful employment is necessary. Pension payable abroad. ***Old-age settlement***: 55 and not entitled to a pension. Retirement from gainful employment is necessary. ***Survivor pension***: The insured person met the old-age or disability pension qualifying requirements or was a pensioner at the time of death. The pension is payable to a widow who was married to the insured for at least one year or who is caring for child	***Old-age pension***: 20 per cent of average monthly earnings in the last 3 or 5 years (whichever is higher), plus 1.33 per cent for every 12-month period of coverage beyond 180 months. The minimum pension is 60 per cent of the national minimum wage. The maximum pension is 80 per cent of the insured's average monthly earnings. ***Old-age settlement***: If ineligible for the old-age pension, a lump sum equal to one month's regular pension for every 6-month period of coverage is payable at age 55. ***Benefit adjustment***: Pensions are adjusted to the cost-of-living changes.	***Survivor pension***: 50 per cent of the pension paid or accrued to the insured person. ***Orphan's pension***: 25 per cent of the insured's pension for each orphan under age 14 (age 18 if an apprentice; 21 if a student or disabled); 40 per cent for each full orphan. The maximum survivor pension is 100 per cent of the insured's pension. ***Survivor settlement***: If the insured person did not meet the qualifying conditions for a pension, a lump sum equal to one month's old-age pension for every 6-month

			or is pregnant. The pension is also payable to a dependent disabled widower. The pension ceases on re-marriage.		period of coverage is payable. **Benefit adjustment**: Pensions are adjusted to cost-of-living changes.
Cameroon	2.8 per cent of earnings	4.2 per cent of payroll; **Government**: None. The maximum monthly earnings for contribution and benefit purposes are 300,000 CFA francs.	**Old-age pension**: 60 with 20 years of insurance coverage and 180 months of contributions, including 60 months in the last 10 years. Retirement from employment is necessary. The pension is payable abroad if there is a reciprocal agreement. **Early pension**: 50 **Old-age grant**: 60 (50 in the case of early retirement) with at least 12 months of contributions. **Survivor pension**: The insured person was a pensioner or met the pension requirements at the time of death. **Survivor grant**: The insured person met the requirements for the old-age grant.	**Old-age pension**: 30 per cent of average monthly earnings in the last 3 or 5 years (whichever is higher) plus 1 per cent for every year of contributions beyond 180 months. The minimum pension is 50 per cent of the legal minimum wage. The maximum pension is 80 per cent of average monthly earnings **Old-age grant**: A lump sum equal to the insured's average monthly earnings times the number of 12-month periods average.	**Survivor pension**: 50 per cent of the insured's old-age pension is payable to all non-divorced spouses regardless of age. **Orphan's pension**: 15 per cent of the insured's old-age pension each; 25 per cent for each full orphan. **Dependent parents**: 10 per cent of the insured's old-age pension. **Other eligible survivors**: The pension is divided equally among other relatives if there are no survivors in the above mentioned categories. The maximum survivor pension is 100 per cent of the insured's pension. **Survivor grant**: A lump sum equal to 1 month of the base pension for each 6-monh contribution period.
	2 per cent of earnings	3 per cent of payroll;	**Old-age pension**: 55 (men) and 50 (women) with 20 years of	**Old-age pension**: 30 per cent of coverage monthly earnings in the last 3 or 5 years	**Survivor pension**: 50 per cent of the insured's pension is

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		Government: None	coverage and 60 months of contributions during the last 10 years. The pension is payable 5 years earlier if the insured person is prematurely aged. Retirement from gainful employment is necessary.

The pension is payable abroad only if there is a reciprocal agreement.

Old-age allowance: 55 (age50 if prematurely aged) with at least 12 months of coverage but ineligible for an old-age pension.

Survivor pension: The insured person met the requirements for a pension or was a pensioner at the time of death.

Survivor Settlement: Paid to the survivor if the insured person did not meet the requirements for a pension. | (whichever is higher), plus 1 per cent for each 12 month period of contributions beyond 240 months.

The minimum pension is 60 per cent of the highest regional minimum wage.

The maximum pension is 80 per cent of average monthly earnings.

Old-age allowance: If ineligible for an old-age pension, a lump sum calculated on the basis of the insured's average monthly earnings for each 12 month period of coverage. | paid to a widow age 50 (age 45 is prematurely aged) or age 30 if caring for child of disabled and provided that she was married at least 2 years prior to the death of the insured. If there is more than one widow, the amount is divided equally. The pension is also payable to a dependent widower age 55 (age 50 if prematurely aged).

Orphan's pension: 50 per cent of the insured's pension; 100 per cent for each full orphan.

The maximum survivor pension is 100 per cent of the insured's pension.

Survivor Settlement: A lump sum of 1 month's old-age pension for every 6-month period of the insurance coverage, if the insured person was ineligible for a person. |
| Central African Republic | | | | | |
| | 3.5 per cent of earnings; voluntarily insured contribute 7 percent of the most recent 6 months' | 3.5 per cent of payroll.

Government: Annual subsidy up to a legally set fixed amount. | **Old-age pension**: 65 (men) and 60 (women); 55 (men and women) if prematurely aged, with 60 months of insurance coverage in the last 10 years. Retirement from paid employment is necessary.

The pension is payable abroad | **Old-age pension**: An annual benefit of 1/60 of average monthly covered earnings times the number of months of insurance coverage.

The minimum pension is 50 per cent of the legal minimum wage.

Old-age settlement: A lump sum equal to 10 | **Survivor pension**: 40 per cent of the insured's person is payable to a widow aged 50 or older or disabled. The pension is also payable to a dependent disabled widower.

Survivor grant: If the insured |

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DR Congo	covered earnings, according to three wage classes.		only if there is a reciprocal agreement. ***Old-age settlement***: The insured person does not meet the qualifying conditions for an old-age pension. The settlement is payable from age 58. Retirement from paid employment is necessary. ***Survivor pension***: The insured person met the pension requirements or was a pensioner at the time of death. ***Survivor grant***: The insured person did not meet the qualifying conditions for pension.	times the annual pension, based on the number of complete years of insurance coverage. The minimum settlement must not be less than 50 per cent of the minimum pension. ***Benefit Adjustment***: Pensions are indexed to changes in wages.	person did not meet the qualifying conditions for a pension, a lump sum equal to 12 months of the insured's pension. ***Orphan's pension***: A lump sum equal to 25 per cent of the survivor grant for each orphan under 16 (age 25 if a student; no limit if disabled); 50 per cent for each full orphan. The maximum orphan's pension is 100 per cent of the survivor grant. ***Benefit adjustment***: pensions are indexed to changes in wage
Ivory Cost (Cote d'Ivoire)	3.2 per cent of earnings	4.8 per cent of payroll ***Government***: None. Maximum monthly earnings for contribution purposes are 1,647,315 CFA francs, which is equal to 45 times the guaranteed minimum wage. The minimum is 36,607 CFA francs.	***Old-age pension***: age 55 with 15 years of contributions and 15 years of covered employment after the program began. Retirement from gainful activity is necessary. The pension is payable abroad. ***Early retirement***: A reduced pension is payable at age 50. ***Old-age allowance***: Older than age 55 with more than 3 years of employment but less than 15 years of contributions. ***Survivor pension***: The insured	***Old-age pension***: 1.33 per cent of average earnings times the number of years of effective or deemed coverage January 1, 2000, and 1.70 per cent for each year of coverage after this date. (some periods of employment before the program began are credited.) ***Early retirement***: The pension is reduced by 5 per cent for each year that the pension is taken before 55. ***Child's supplement***: 10 per cent of the insured's pension for each child under age 16, up to a maximum of 30 per cent of the insured's pension.	***Survivor pension***: 50 per cent of the insured's pension is payable to widow(er) age 50 or older. There is no age requirement if the widow(er) was married for at least 2 years or has a dependent child. ***Orphan's pension***: 20 per cent of the insured's pension for each full orphan under age 16 (age 21 if student). The maximum orphan's pension is 100 per cent of the insured's pension.

			was a pensioner of met the requirement for pension at the time of death.	*Old-age allowance*: A lump sum payment. *Benefit adjustment*: Pensions are adjusted annually to changes in the average salary subject to contributions.	
Kenya	5 per cent of earnings	5 per cent of payroll; *Government*: None. The maximum monthly earnings for contribution purposes are 4,000 shillings.	*Old-age pension*: 55 and substantial retirement from regular employment. The benefit is payable at age 50 if not in insured employment or at any age if emigrating permanently. *Survivor benefit*: The death of the fund member prior to retirement.	*Old-age benefit*: A lump sum equal to total employee and employer contributions, plus interest.	*Survivor benefit*: A lump sum equal to total employee and employer contributions, plus interest. The benefit is payable to the spouse and children or, if none, to other dependent relatives.
Benin	3.6 per cent of earnings	6.4 per cent of payroll; *Government*: None	*Old-age pension*: 55 with 180 months of contributions. Retirement from gainful employment is necessary. *Survivor pension*: The insured was a pensioner or met the pension requirements at the time of death or had 180 months of insurance coverage. All pensions are payable abroad if there is a reciprocal agreement.	*Old-age pension*: 20 per cent of average monthly earnings during the last 10 years. An increment of 2 per cent is paid for every year of the insurance coverage beyond 15 years. The minimum pension is 60 per cent of the guaranteed minimum wage. The maximum pension is 60 per cent of average monthly earnings. *Old-age settlement*: If ineligible for an old-age pension at age 55 but with at least 12 months of contributions, the settlement is equal to 1 month's wages for each year of insurance coverage. *Benefit adjustment*: Pensions are adjusted for cost-of-living changes, depending on the financial resources of the system.	*Survivor pension*: 40 per cent of the insured's pension is paid to a widow. The pension is also payable to dependent disabled widower if married at least 1 year before the death of the spouse. *Orphan's pension*: 20 per cent of the insured's pension for one orphan, 40 per cent for two or more orphans; 30 per cent for full orphan who is single child. The maximum survivor pension is 80 per cent of the insured's pension. *Survivor settlement*: If the insured person failed to meet the qualifying conditions for pension, 1 month of the

					insured's accrued pension for each 6-month period of insurance coverage. In the absence of an eligible spouse or orphans, the settlement is paid to the insured's parents. ***Benefit adjustment***: Pensions are adjusted for cost-of-living changes, depending on the financial resources of the system.
Chad	2 per cent of earnings	4 per cent of payroll; ***Government***: None Worker's incomes are determined by the provisions of the labour code	***Old-age pension***: 55 (age 50 if prematurely aged) with 180 months of insurance coverage or 60 months of contributions during the last 10 years. Retirement from gainful employment is necessary. ***Old-age settlement***: 55 (age 50 if prematurely aged) and ineligible for the old-age pension. ***Survivor pension***: The insured pension met the pension requirements, was a pensioner, or had 180 months of insurance coverage at the time of death. ***Survivor settlement***: Paid to a survivor if the insured person was ineligible for a pension.	***Old-age pension***: 30 per cent of average monthly earnings during the last 3 or 5 years (whichever is higher), plus an increment of 1.2 per cent for every 12-month period of insurance coverage beyond 180 months. The minimum pension is 60 per cent of the highest minimum wage. The maximum pension is 80 per cent of the earnings. ***Old-age settlement***: If ineligible for the old-age pension, a lump sum equal to 1 month's wages for each year of insurance coverage.	***Survivor pension***: 50 per cent of the insured's pension is paid to a widow aged 40 or older, caring for a child, pregnant or disabled, provided that she was married at least 1 year prior to the insured's death. If there is more than one widow, the pension is divided equally. A pension is also payable to a dependent disabled widower if he was married at least 1 year prior to the insured's death. ***Orphan's pension***: 25 per cent of the insured's insured pension for each orphan; 40 per cent for full orphan. ***Survivor settlement***: A lump sum payment is the insured was ineligible for a pension.

Ethiopia	4 per cent of basic salary	6 per cent (civilian) or 16 per cent (military) of payroll; *Government*: None	*Old-age pension*: 55 with a minimum of 10 years of service and contributions. *Old-age settlement*: 55 for those who do not meet the qualifying conditions for the old-age pension. *Survivor pension*: the insured met the contribution conditions for the old-age pension or was a pensioner at the time of the death.	*Old-age pension*: 30 per cent of the average monthly salary during the last 3 years, plus an increment of 1 per cent (civilian) or 1.5 per cent (military) of the average monthly salary for each year of service beyond 10 years. The maximum benefit is 60 per cent of the average monthly salary. *Old-age settlement*: A lump sum payment.	*Survivor pension*: The widow(er) receives 50 per cent of the insured's pension. Entitlement to the pension ceases on re-marriage. On remarriage, a lump sum of 2 years' pension is paid. *Orphan's pension*: 10 per cent of the insured's pension each; 20 per cent each for full orphans. *Dependent parents*: 10 to 20 per cent of the insured's pension.
Congo (Brazzaville)	2.4 per cent of earnings.	3.6 per cent of payroll; *Government*: None The minimum monthly earnings for contributions and benefit purposes are 23,500 CFA francs. There is no maximum earnings level for contribution and benefit purposes.	*Old-age pension*: 55 (or age 50 if prematurely aged) with insurance coverage during the last 20 years, or 240 months' total insurance of which 60 months were in the last 5 years. The pension is proportionately reduced if the insured person has between 60 and 239 months of contributions. Retirement from paid employment is necessary. The pension is payable to insured non citizens who leave the country only if there is a reciprocal agreement. *Old-age settlement*: The insured person does not meet the qualifying conditions for a pension.	*Old-age pension*: 40 per cent of average monthly earnings in the last 3 or 5 years (whichever is higher), plus 2 per cent of average monthly earnings for every 12-month period of insurance beyond 240 months. The years chosen for benefit calculation purposes must be in the 10-years period prior to the date of eligibility for pension. The minimum pension is 60 per cent of the highest guaranteed minimum wage. The maximum pension is 80 per cent of earnings. *Old-age settlement*: A lump sum equal to the insured's average monthly earnings for every 12-month insurance period credited at age 55 (age 50 if prematurely aged) if ineligible for a pension.	*Survivor pension*: 30 per cent of the insured's pension is payable to the widow(er). Orphan's pension: 50 per cent of the insured's pension. The maximum survivor pension is 80 per cent of the insured's pension. *Survivor settlement*: If the insured person did not qualify for a pension, 1 month's basic old-age pension for each 6-month period of contributions. *Benefit adjustment*: Pensions are adjusted for cost-of-living changes.

			Survivor pension: The insured person met the qualifying conditions for a pension or was a pensioner at the time of death. *Survivor settlement*: the insured person did not qualify for a pension	*Benefit adjustment*: Pensions are adjusted for cost-of-living changes.	
			Old-age pension: 55 (age 50 if prematurely aged) with 20 years of insurance and 120 months of contributions during the last 20 years; for those insured since May 1, 1964, 60 months of contributions during the last 10 years. Retirement is payable abroad only if there is a reciprocal agreement. Foreign workers who permanently leave the country may have their contribution reimbursed. *Old-age settlement*: The insured person is ineligible for an old-age pension. *Survivor pension*: The insured person had 120 months of contributions, met the contribution conditions for pension, or was a pensioner at the time of death. *Survivor settlement*: The insured person worked until age 55 but	*Old-age pension*: 40 per cent of average earnings during the last 3 or 5 years (whichever is higher), plus an increment of 1 per cent of the earnings for each 12-month period of contributions beyond 240 months. The maximum pension is 85 per cent of average earnings. *Old-age settlement*: A lump sum equal to 50 per cent of average monthly earnings for each 6-month period of contributions, if the insured person is ineligible for the pension.	*Survivor pension*: 50 per cent of the insured's old-age pension is paid to a nonworking or disabled; also payable to a dependent disabled widower. If there is more than one widow, the pension is divided equally. *Orphan's pension*: 20 per cent of the insured's pension for each orphan; 30 per cent for a full orphan. An orphan's mother who is ineligible for the widow's pension receives 35 per cent of insured's pension. The maximum survivor pension is 85 per cent of the insured's pension. *Survivor settlement*: A lump sum equal to 100 per cent of insured's monthly old-age pension for each 6-month period of contributions, if ineligible for the survivor

			did not have 120 months of contributions.		pension.
			Old-age pension: 55 (age 50 if unable to work) with 15 years of contributions. Retirement from gainful employment is necessary. *Early pension*: age 50. *Survivor pension*: The insured person was a pensioner or in insured employment at the time of death.	*Old-age pension*: about 2 per cent of base earnings times the number of years of insurance coverage (some periods of incapacity are credited). The maximum number of years for benefit calculation purposes is 30. *Early pension*: The pension is reduced by between 5 per cent and 10 per cent for each year that the pension is received before age 55.	*Survivor pension*: 50 per cent of the pension paid of accrued to the insured if caring for child or age 50 or older at any age if the widow of an old-age pensioner. *Orphan's pension*: 10 per cent of the insured's pension to each orphan; 20 per cent for each full orphan. The maximum orphan's pension is 100 per cent of the insured's pension. *Funeral grant*: A lump sum of 90 days' earnings, but no less than 2,500francs.
			Old-age pension *Basic pension (non-contributory)*: 60 with 12 years of residence after age 18 for Mauritian nationals. There is no residence qualification if aged 70 or older. Non-citizens must have lived in the country for 15 years since age 40, including the 3 years immediately prior to the date of claim. The basic pension is not income-tested or retirement-tested.	Old-age pension *Basic pension (non-contributory)*: The value of the pension increases with age. For ages 60 to 89, Rs1, 700 an month; for ages 90 to 99, Rs6, 400; and if aged 100 or older, Rs 7,300. *Enhanced basic pension*: An additional Rs 1,205 is payable if blind or 100 per cent disabled or need of the constant care and attention of another person. *Earnings-related pension (social security)*: The pension is calculated on the basis of pension points that are awarded in exchange	Survivor benefit *Basic widow's pension (non-contributory)*: Rs 1, 700 a month. *Child allowance*: Allowances are paid for the first three children of the widows under age 60. children must be under age 15 (20 if in full-time education). The allowance is Rs555 a month for a child under age 10 and 595 if aged 10 or older. The

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			Earnings-related pension (contributory): 60 and insured. Survivor pension **Basic widow's pension (non-contributory)**: The pension is paid to a widow under age 60. non-citizen widows must have 5 years of residence during the 10 years of preceding the claim and must have been resident during the year preceding the claim. Entitlement to the pension ceases on remarriage. **Earnings-related widow's pension (contributory)**: The widow's spouse met the requirements for a pension or was a pensioner at the time of death. **Earnings-related orphan's pension (contributory)**: Paid to an orphan under age 15 (age 18 is in full-time education) if either of the deceased parents had paid contributions.	for contributions. At retirement, the pension points are converted to pension. The value of pension points is set by government. **Benefit adjustment**: Pensions are adjusted for cost-of-living changes.	allowance continues even if the child's mother remarries. **Orphan's pension (non-contributory)**: Rs725 a month up to age 15 (age 20 if in full-time education). **Guardian allowance (non-contributory)**: Rs320 a month to the person looking after an orphan. **Earnings-related widow's pension**: for a widow younger than age 60, the maximum pension is 20 times the average annual number of pension points times the value of one pension point divided by 12. the value of pension points is set by the Government. The pension is reduced by one-third after 12 months if there are no dependent children. A widow aged 60 or older receives 100 per cent of the insured's pension. **Remarriage settlement**: A lump sum equal to 12 months' widow's pension is payable on remarriage. **Earnings-related orphan's pension**: 15 per cent of the

					insured's pension. ***Benefit adjustment***: Pensions are adjusted for cost-of-living changes.
Nigeria	3.5 per cent of gross salary (gross salary includes basic salary and housing and transport allowances).	6.5 per cent of gross salary (gross salary includes basic salary and housing and transport allowances); ***Government***: None The maximum annual earnings for contribution and benefit purposes are 48,000 naira	***Old-age pension***: 60 with 120 months of contributions. Retirement from regular employment is necessary. ***Retirement grant***: 60 with at least 12 months of contributions. Retirement from regular employment is necessary. ***Survivor pension***: The insured was eligible for the old-age or disability pension at the time of death. ***Survivor grant***: The insured person was eligible for the retirement or disability grant at the time of death. ***Funeral grant***: The insured person was receiving the retirement or disability pension or had 60 months of contributions.	***Old-age pension***: 30 per cent of average monthly insurable earnings, plus 1.5 per cent of those earnings for each 12-month period of paid or credited contributions exceeding 120 months of contributions. The minimum pension is 4,400 naira a month (80 per cent of the national minimum wage). The maximum pension is 65 per cent of average monthly contributions. ***Retirement grant***: A lump sum equal to the final month's contributions multiplied by the number of months of contributions.	***Survivor pension***: 100 per cent of the insured's pension. The pension is payable to a survivor spouse or other dependent relatives. ***Survivor grant***: 100 per cent of the insured's retirement grant or disability grant. ***Funeral grant***: A lump sum of 2,000 naira.
	4.8 per cent earnings; management personnel contribute an additional 2 per cent for	7.2 per cent of payroll; management personnel contribute an additional 3 per cent of earnings up to 600,000 CFA francs a month for	***Old-age pension***: 55 with 1 year of contributions. Retirement from employment is necessary. ***Early pension***: A reduced pension is payable from age 53.	***Old-age pension***: about 1.33 per cent of base earnings times the number of years of insurance coverage, according to a point system. The maximum number of years for benefit calculation purposes is 30. Periods of employment completed before the implementation of the current program are	***Survivor pension***: The pension is payable to a widow aged 50 or to a widower aged 55 or disabled. The pension is 50 per cent of the insured's pension if the survivor is aged 50 or older

Senegal	supplementary benefits.	supplementary benefits; *Government*: None The maximum monthly earnings for contribution and benefit purposes are 300,000 CFA francs.	*Means-tested allowance*: if eligible for the old-age pension, the allowance is payable at age 55 to persons born before 1922 with at least 10 years of employment as domestic worker. *Survivor pension*: The insured person was a pensioner or met the contribution requirements for a pension at the time of death.	credited toward insurance coverage if the insured person has at least 10 years of covered employment before or after the program began. (Credited employment periods are given for periods of incapacity for work). *Early pension*: The old-age pension is reduced by 5 per cent for each year the person is awarded before age 55. *Child's supplement*: 5 per cent of the insured's pension for each dependent child under age 18. The maximum supplement is 15 per cent of the insured's pension. *Means-tested allowance*: A variable cash benefit.	(payable up to 5 years earlier with 5 per cent reduction per year) or caring for two dependent children under age 18. *Orphan's pension*: 20 per cent of the insured's pension for each full orphan under age 18. The maximum survivor pension is 100 per cent of the insured's pension.
Sierra Leone	5 per cent of earnings; the self-employed contribute 15 per cent of income.	10 per cent of payroll; *Government*: None	*Old-age pension*: 60 with at least 15 years of insurance coverage. *Survivor pension*: The insured person met the qualifying conditions or was receiving an old-age or disability pension or had at least 5 years of contributions of which 12 months were paid in the 3 years preceding death.	*Old-age pension*: The pension is calculated on the basis of 30 per cent of the insured's average earnings for the first 15 years of coverage, plus 2 per cent of the insured's average earnings for each additional 12-month period. Periods of employment before the introduction of the new scheme may be credited. The minimum pension is not less than 50 per cent of the minimum wage. The maximum pension is 80 per cent of the insured's average earnings.	*Survivor pension*: 40 per cent of the insured's pension is payable to a widow(er). In the case of more than one widow, the pension is shared equally. The widow's pension ceases on remarriage. *Orphan's pension*: 60 per cent of the insured's pension for an orphan up to age 18 (23 if in full-time education; no limit if disabled). *Other eligible survivors (in his absence of the above)*: A lump sum equal to 12

				Early pension: A reduced pension is payable from age 55. The pension is reduced by 4 per cent for each yea that the pension is taken before age 60. *Deferred pension*: The insured person can continue working after age 60. The maximum number of insurable years is 40. *Retirement grant*: If the insured person is of pensionable age but has insufficient contributions to qualify for an early retirement pension, a grant equal to 1.5 times the insured's average monthly earnings for each 12-month period of contributions is paid. *Benefit adjustment*: Pensions are adjusted annually according to trust fund income.	months' pension is payable to parent who is employed or receiving a pension; 24 months' pension to a parent who is not employed or receiving a pension. The maximum survivor pension is 100 per cent of the insured's pension. *Survivor grant*: If the qualifying conditions for a survivor pension are not met, a grant equal to 1.5 times the insured's average monthly earnings for each 12-month period of contributions is paid. Benefit adjustment: pensions are adjusted annually according to trust fund income.
Ghana	5 per cent of earnings; self-employed contribute 17.5 per cent of income.	12.5 per cent of payroll; *Government*: None	*Old-age pension*: 60 (55 to 59 for underground mine workers, steel mill workers, or employees engaged in other types of hazardous employment) with at least 240 months of contributions. *Early pension*: A reduced pension is payable from ages 55 to 59. *Old-age grant*: for insured persons with insufficient contributions for the old age	*Old-age pension*: The minimum pension is 50 per cent of the average annual salary in the 3 best years of earnings. The pension is increased by 1.5 percentage point for each 12-month period of contribution beyond 240 months. The maximum pension is not to exceed 80 per cent of the average earnings of the top 5 per cent of contributing members. The insured person may opt to take 25 per cent of the pension as a lump sum.	Survivor pension: If the insured was a pensioner at the time of death, the benefit is payable as lump sum calculated on the present value of the pension that would have been received after the date of death until age 72. if the insured was not a pensioner but had 240 months of contributions, a lump sum benefit equal to the present proportional value of

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			benefit. **Survivor benefit**: The death of the insured person before age 72.	**Old-age grant**: a lump sum equal to the full refund of contributions plus interest set at 50 per cent of the prevailing government treasury rate.	12 years' pension. (The present value of the pension is calculated using 50 per cent of the prevailing treasury bill rate of interest.) The pension is payable to named dependents.
Tanzania	**Provident fund**: 10 per cent of wages. **Social insurance**: 5 or 10 per cent of wages	**Provident fund**: 10 per cent of payroll. **Social insurance**: 10 per cent of payroll. In both cases, **Government**: None.	**Provident fund**: 55 and retired from regular employment. The full benefit is also payable at any age in to workers emigrating permanently. Benefit is payable to workers under age 55 who are unemployed or have been in non-contributory employment for at least 6 months. **Survivor benefit**: The death of the insured worker before retirement or emigration. **Social insurance**: 55 with at least 10 years of contributions. **Old-age gratuity**: 55 and entitled to an old-age pensioner if the insured person ceases employment for reasons other than dismissal or medical grounds and does not meet the qualifying conditions for an old-age pension. **Survivor benefit**: Paid to the insured's estate if the insured has at least 10 years of contributions. **Death benefit**: Paid to the legal	Provident fund **Old-age benefit**: A lump sum equal to total employee and employer contributions, plus accrued interest. For a worker under age 55 who is unemployed or who has been in non-contributory employment for at least 6 months, 1/3 of the total benefit is payable after 6 months and the remaining 2/3 after 12 months. The benefit is payable in full to workers who retire from employment to live in a village. Social insurance **Old-age benefit**: A monthly pension. The pension is guaranteed for 3 years. **Old-age gratuity**: A lump sum equal to the insured's and the employer's total contributions.	Provident fund **Survivor benefit**: A lump sum equal to the insured's and the employer's total contributions, plus accrued interest. The benefit is payable to surviving relatives or other heirs. Social insurance **Survivor benefit**: A monthly pension **Death benefit**: a lump sum. **Education benefit**: The benefit varies according to family circumstances. **Survivor settlement**: A lump sum.

			representative of an insured person who dies while in service. ***Education benefit***: Paid to meet part of the education costs of the children of a person who dies in service. The benefit is payable for up to four children and covers cost for nursery, primary, and secondary education. ***Survivor settlement***: Paid to the insured's estate if the insured did not meet the qualifying conditions for a pension.		
Mauritius	***Social insurance***: 3 per cent of earnings ***Basic pension*** (Non-contributory): None	***Social insurance***: 6 per cent payroll; 10.5 per cent for millers and large employers in sugar industry (also it finance work injury benefits). ***Government***: **Universal pension** (non-contributory): Total cost; Social insurance: government cover any deficit (minimum earning for contribution is Rs975 and the maximum contribution is Rs6, 435	***Basic pension (non-contributor):*** Age 60 with 12 years of residence after age 18 for Mauritian nationals. No residence qualifications for age 70 and older. Non-citizens qualifying conditions is that an individual must have lived in the country 15 years since age 40, including the three years preceding the date of claim. ***Social insurance (contributory)***: Age 60 and he/she must be insured.	Old-age pension ***Basic pension (non-contributory):*** the value of pension increase with age. For age 60 to 89, Rs1, 700 a month; age 90 to 99, Rs6, 400; and for age 100 and older, Rs7, 300. ***Enhanced basic pension:*** An additional Rs1, 205 is payable if blind or 10 per cent disabled or need of the constant care and attention of another person. ***Social insurance (contributory)***: The pension is calculated on the base of pension points that are awarded in exchange for contributions. At retirement, the pension points are converted to a pension. The value of pension points is set by the government. ***Benefit adjustment:*** Pensions are adjusted for cost-of-living changes.	Survivor pension ***Basic widow's pension (non-contributory):*** Rs1, 700 a month. ***Child allowance***: allowances are paid for the first three children of widows under age 60. Children must be under age 15 (age 20 if in full education). The allowance is Rs555 a month for a child under 10 and Rs 595 for age 10 and older. The allowance continues even if the child's mother remarries. ***Orphan's pension (non-contributory):*** Rs725 a month up to age 15 (age 20 if in full education).

| | | | | | *Guardian allowance (non-contributory):* Rs320 a month to a person looking after an orphan. |
					Social insurance widow's pension: for widow younger than age 60, the maximum pension is 20 times the average annual number of pension points times the value of one pension point times by 12. The value of the pension point is set by the government. The pension is reduced by one-third after 12 months if there are no dependent children. A widow aged 60 or older receives 100 per cent of the insured's pension.
					Remarriage settlement: A lump-sum equal to 12 months' widow's pension is payable on remarriage.
					Social insurances orphan's pension: 15 per cent of the insured's pension.
					Benefit adjustment: Pensions are adjusted for cost-of-living changes.

Source: www.socialsecurity.gov

Annexure 3: Saving Regression in SADC Countries

3.1 Growth of per capita GDP

3.1.1 Bootstrapped coefficient in the SADC countries saving regression

The results of the bootstrapped coefficient in the growth of per capita GDP show that the coefficient is right hand skewed with a mean 2.5517. The results above show that Jarque-Bera test is 8.1687 with p-value = 0.0168, rejecting the standard normality assumptions and therefore the bootstrapped results are preferable. This approach was used in analysing all the results present in this study.

Figure 3.1: EDF of the coefficient for the Growth of Per Capita GDP in SADC
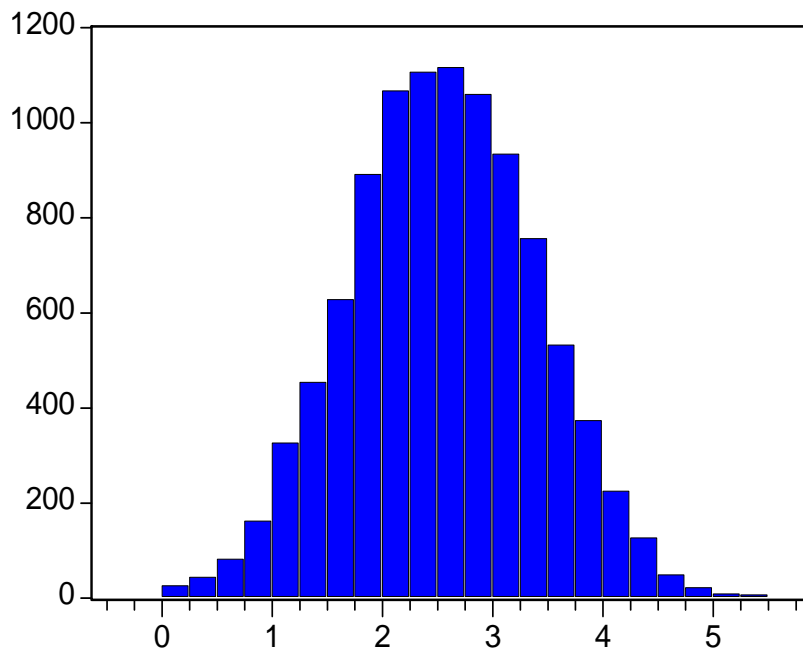
3.1.2 Results of the empirical distribution test for the growth of per capita GDP coefficient in the SADC countries saving regression

The results of the empirical distribution test on the growth of per capita GDP coefficient reject the standard normality ($\mu=0$ and $\sigma=1$) but the normality passes for $\mu= 2.5517$ and $\sigma=0.0010$ values based on the results shown in figure 3.1. This test justifies even further the use of bootstrapping of the LSDV regression results. This approach was used in analysing all the results present in this study.

Table 3.1

Empirical Distribution Test for GGDPPC				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.038552	3.859834	0.0000	
Kolmogorov (D-)	0.039197	3.924487	0.0000	
Kolmogorov (D)	0.039197	3.924487	0.0000	
Kuiper (V)	0.077749	7.787143	0.0000	
Cramer-von Mises (W2)	7.042912	7.043577	0.0000	
Watson (U2)	7.042482	7.043035	0.0000	
Anderson-Darling (A2)	59.83453	59.83453	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	2.551700	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-12790.19	Mean dependent var.		2.551671
No. of Coefficients	0	S.D. dependent var.		0.848665
* Fixed parameter value				

3.2 Inflation

3.2.1 Bootstrapped coefficient in the SADC countries saving regression

Figure 3.2: EDF of the Inflation coefficient in SADC
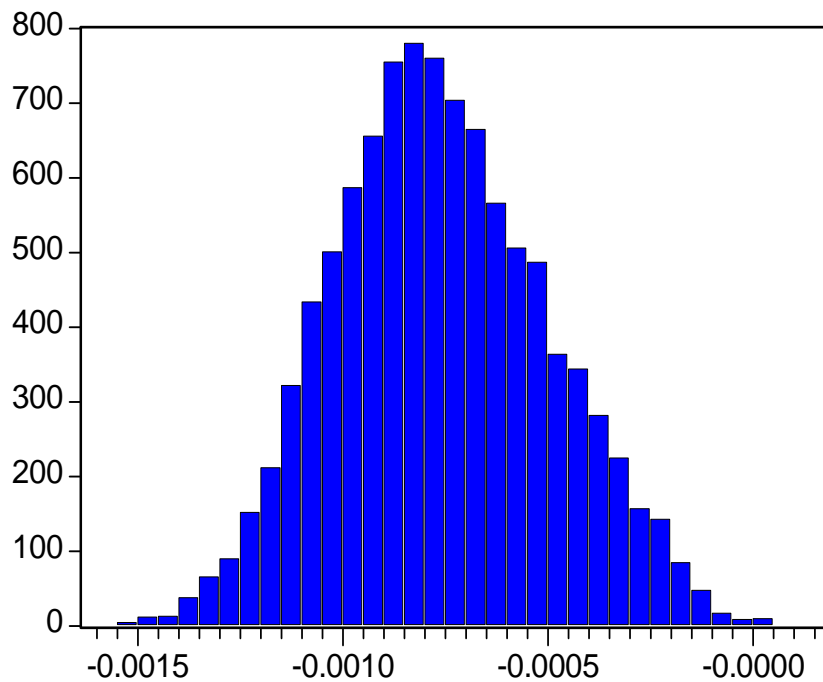
3.2.2 Results of the empirical distribution test for the inflation coefficient in the SADC countries saving regression
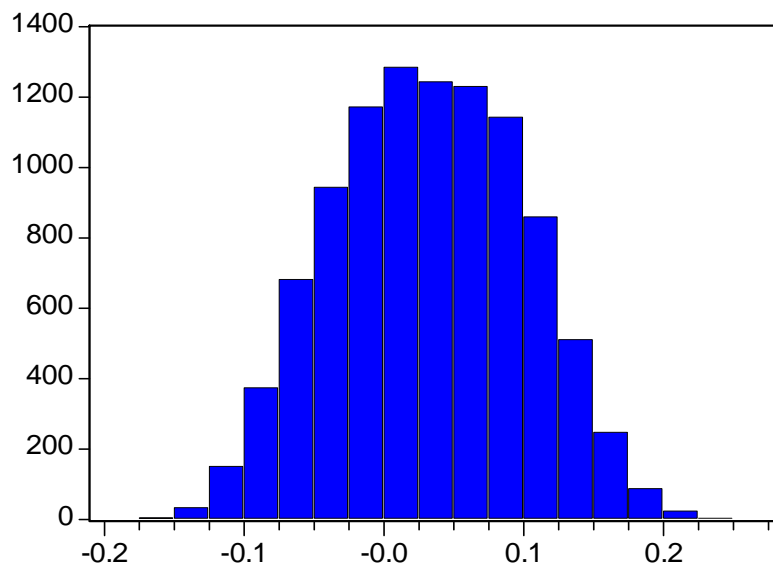
Table 3.2

Empirical Distribution Test for INFL				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.276191	27.65250	0.0000	
Kolmogorov (D-)	0.293175	29.35300	0.0000	
Kolmogorov (D)	0.293175	29.35300	0.0000	
Kuiper (V)	0.569366	57.02617	0.0000	
Cramer-von Mises (W2)	359.7319	359.7678	0.0000	
Watson (U2)	359.7312	359.7599	0.0000	
Anderson-Darling (A2)	1913.684	1913.684	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.000760	*	NA	NA
SIGMA	0.001000	*	NA	NA
Log likelihood	59546.26	Mean dependent var.		-0.000760
No. of Coefficients	0	S.D. dependent var.		0.000262
* Fixed parameter value				

3.3 Benefit payments to GDP ratio

3.3.1 Bootstrapped coefficient in the SADC countries saving regression

Figure 3.3: EDF of the coefficient for the Benefit Payments to GDP ratio in SADC

3.3.2 Results of the empirical distribution test for the Benefit payments to GDP ratio coefficient in the SADC countries saving regression
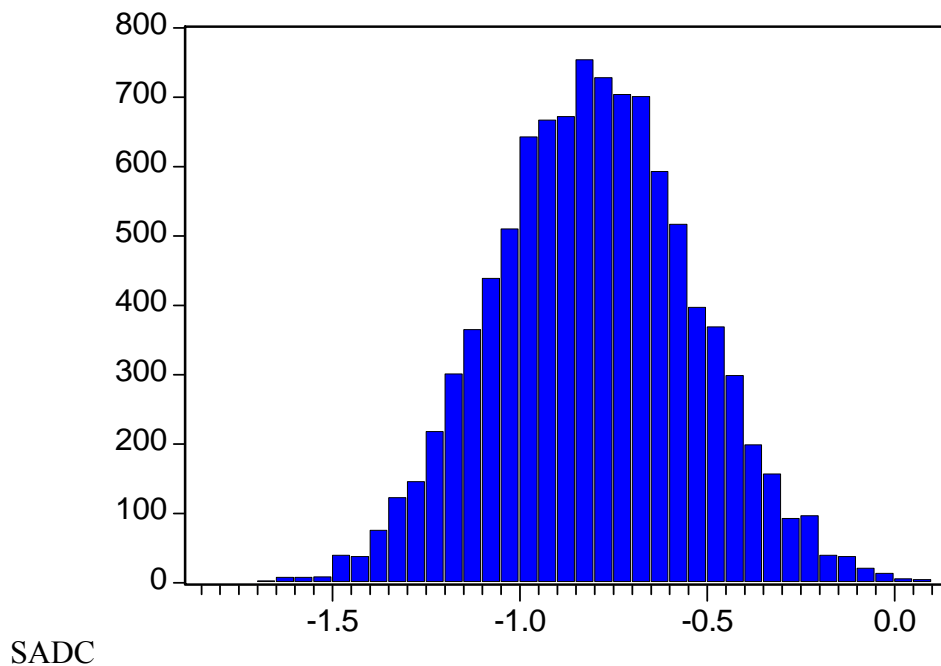
Table 3.3

Empirical Distribution Test for RATIOBEN				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.433451	43.39761	0.0000	
Kolmogorov (D-)	0.434065	43.45911	0.0000	
Kolmogorov (D)	0.434065	43.45911	0.0000	
Kuiper (V)	0.867517	86.88821	0.0000	
Cramer-von Mises (W2)	686.5644	686.6330	0.0000	
Watson (U2)	686.5644	686.6193	0.0000	
Anderson-Darling (A2)	3274.654	3274.654	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	0.032173	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9212.283	Mean dependent var.		0.032173
No. of Coefficients	0	S.D. dependent var.		0.067676
* Fixed parameter value				

3.4 Net exports to GDP ratio

3.4.1 Bootstrapped coefficient in the SADC countries saving regression

Figure 3.4: EDF of the Net Exports to GDP ratio coefficient in

SADC

3.4.2 Results of the empirical distribution test for the net exports to GDP ratio coefficient in the SADC countries saving regression
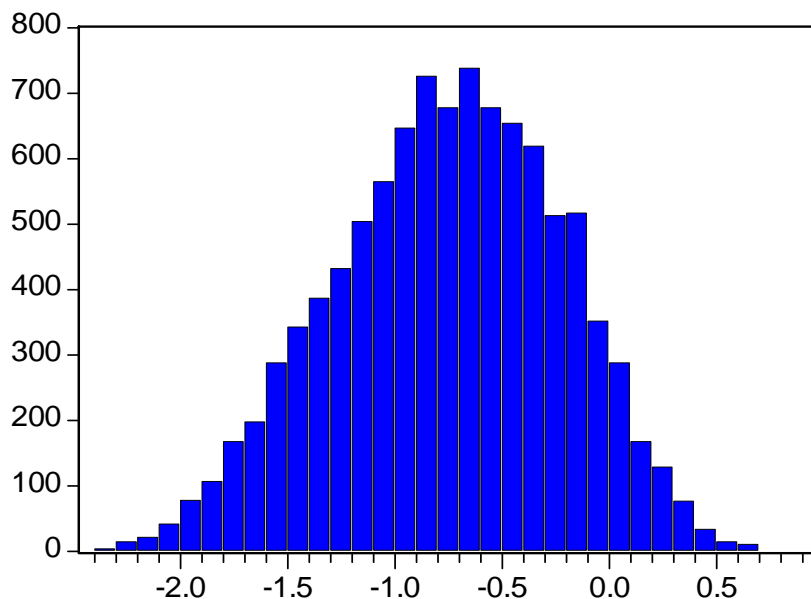
Table 3.4

Empirical Distribution Test for RATIONX				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.280364	28.07034	0.0000	
Kolmogorov (D-)	0.281645	28.19858	0.0000	
Kolmogorov (D)	0.281645	28.19858	0.0000	
Kuiper (V)	0.562009	56.28933	0.0000	
Cramer-von Mises (W2)	353.7051	353.7405	0.0000	
Watson (U2)	353.7051	353.7334	0.0000	
Anderson-Darling (A2)	1885.043	1885.043	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.800397	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9547.597	Mean dependent var.		-0.800397
No. of Coefficients	0	S.D. dependent var.		0.267674
* Fixed parameter value				

3.5 Government deficit to GDP ratio

3.5.1 Bootstrapped coefficient in the SADC countries saving regression

Figure 3.5: EDF of the Government Deficit to GDP ratio coefficient in SADC

3.5.2 Results of the empirical distribution test for the government deficit to GDP ratio coefficient in the SADC countries saving regression
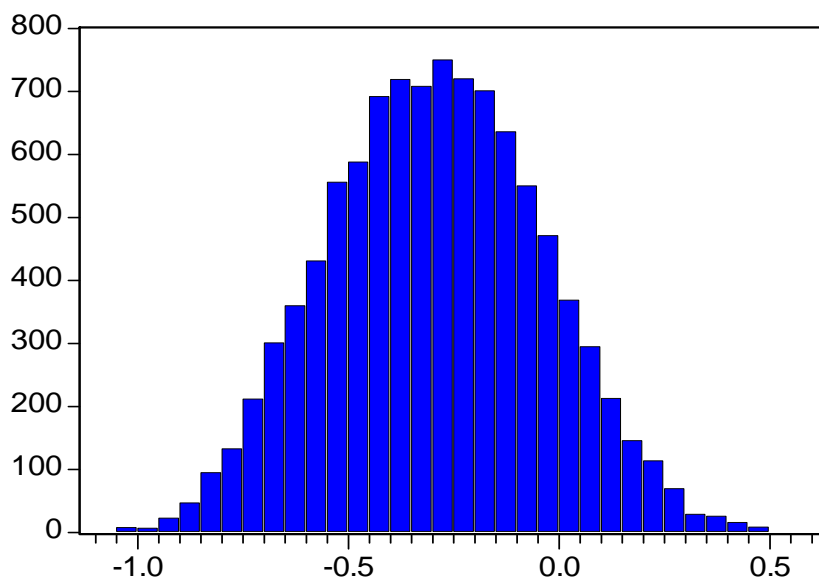
Table 3.5

Empirical Distribution Test for RDEF				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.156098	15.62869	0.0000	
Kolmogorov (D-)	0.136534	13.66991	0.0000	
Kolmogorov (D)	0.156098	15.62869	0.0000	
Kuiper (V)	0.292632	29.30922	0.0000	
Cramer-von Mises (W2)	103.8734	103.8838	0.0000	
Watson (U2)	103.8572	103.8655	0.0000	
Anderson-Darling (A2)	681.5729	681.5729	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.752300	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-10591.55	Mean dependent var.		-0.752300
No. of Coefficients	0	S.D. dependent var.		0.529586
* Fixed parameter value				

3.6 Government consumption to GDP ratio

3.6.1 Bootstrapped coefficient in the SADC countries saving regression

Figure 3.6: EDF of the Government Consumption to GDP ratio coefficient in SADC

3.6.2 Results of the empirical distribution test for the government consumption to GDP ratio coefficient in the SADC countries saving regression

Table 3.6

Empirical Distribution Test for RGCONS				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.289560	28.99111	0.0000	
Kolmogorov (D-)	0.292920	29.32749	0.0000	
Kolmogorov (D)	0.292920	29.32749	0.0000	
Kuiper (V)	0.582481	58.33974	0.0000	
Cramer-von Mises (W2)	369.4880	369.5249	0.0000	
Watson (U2)	369.4880	369.5175	0.0000	
Anderson-Darling (A2)	1957.120	1957.120	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.292143	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9510.893	Mean dependent var.		-0.292143
No. of Coefficients	0	S.D. dependent var.		0.253590
		* Fixed parameter value		

Annexure 4: Saving Regression in West African Countries

4.1 Growth of per capita GDP

4.1.1 Bootstrapped coefficient in the West African countries saving regression

The results of the bootstrapped coefficient in the growth of per capita GDP show that the coefficient is right hand skewed with a mean 1.1118. The results above show that Jarque-Bera test is 12.1740 with p-value = 0.0023, rejecting the standard normality assumptions and therefore the bootstrapped results are preferable. This philosophy was used in analysing all the results present in this study.

Figure 4.1: EDF of the coefficient for the Growth of per Capita GDP in West Africa
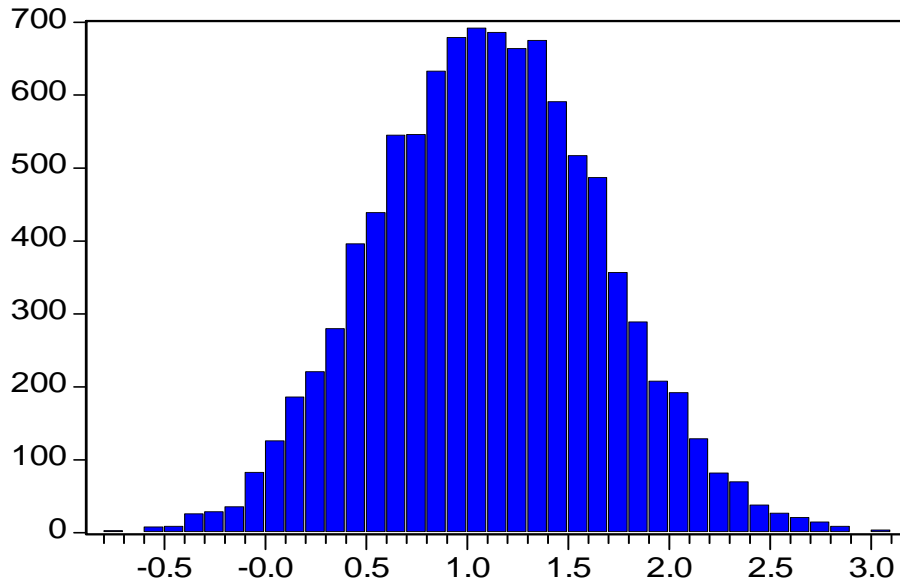
4.1.2 Results of the empirical distribution test for the growth of per capita GDP coefficient in the West African countries saving regression

The results of the empirical distribution test on the growth of per capita GDP coefficient reject the standard normality ($\mu=0$ and $\sigma=1$) but the normality passes for $\mu= 1.1118$ and $\sigma=0.0010$ values based on the results shown in figure 5.1. This test justifies even further the use of bootstrapping of the LSDV regression results. This approach was used in analysing all the results present in this study.

Table 4.1

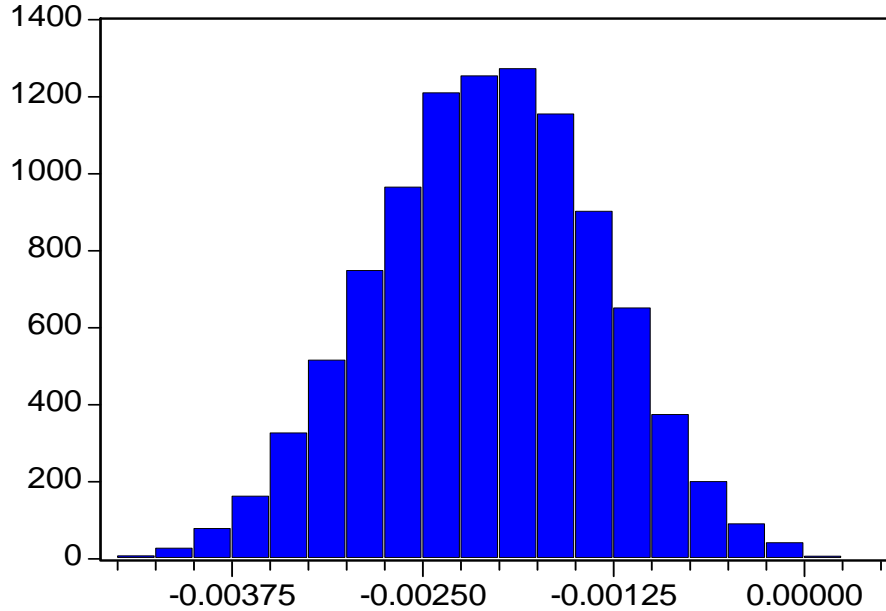| Empirical Distribution Test for GGDPPC				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.139035	13.92037	0.0000	
Kolmogorov (D-)	0.138572	13.87393	0.0000	
Kolmogorov (D)	0.139035	13.92037	0.0000	
Kuiper (V)	0.277607	27.80438	0.0000	
Cramer-von Mises (W2)	92.84354	92.85278	0.0000	
Watson (U2)	92.84099	92.84840	0.0000	
Anderson-Darling (A2)	609.1907	609.1907	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	1.111800	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-10749.52	Mean dependent var.		1.111837
No. of Coefficients	0	S.D. dependent var.		0.558621
* Fixed parameter value				

4.2 Inflation

4.2.1 Bootstrapped coefficient in the West African countries saving regression

Figure 4.2: EDF of the coefficient for Inflation in West Africa

4.2.2 Results of the empirical distribution test for the inflation coefficient in the West African countries saving regression
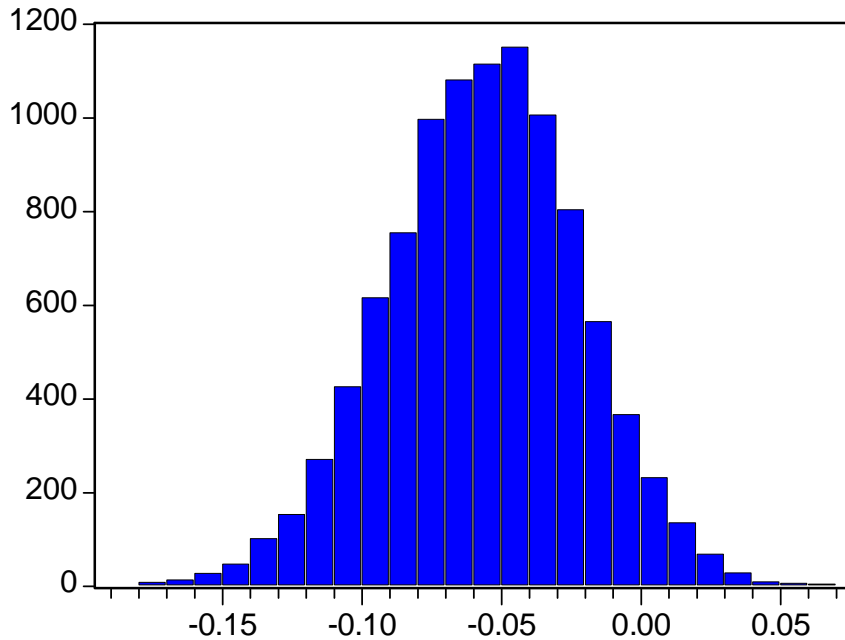
Table 4.2

Empirical Distribution Test for INFL				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.423827	42.43399	0.0000	
Kolmogorov (D-)	0.422127	42.26380	0.0000	
Kolmogorov (D)	0.423827	42.43399	0.0000	
Kuiper (V)	0.845953	84.72850	0.0000	
Cramer-von Mises (W2)	674.3892	674.4566	0.0000	
Watson (U2)	674.3892	674.4431	0.0000	
Anderson-Darling (A2)	3225.460	3225.460	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.002073	*	NA	NA
SIGMA	0.010000	*	NA	NA
Log likelihood	36834.71	Mean dependent var.		-0.002073
No. of Coefficients	0	S.D. dependent var.		0.000743
* Fixed parameter value				

4.3 Benefit payments to GDP ratio

4.3.1 Bootstrapped coefficient in the West African countries saving regression

Figure 4.3: EDF of the coefficient for the Benefit Payments to GDP ratio in West Africa

4.3.2 Results of the empirical distribution test for the Benefit payments to GDP ratio coefficient in the West African countries saving regression
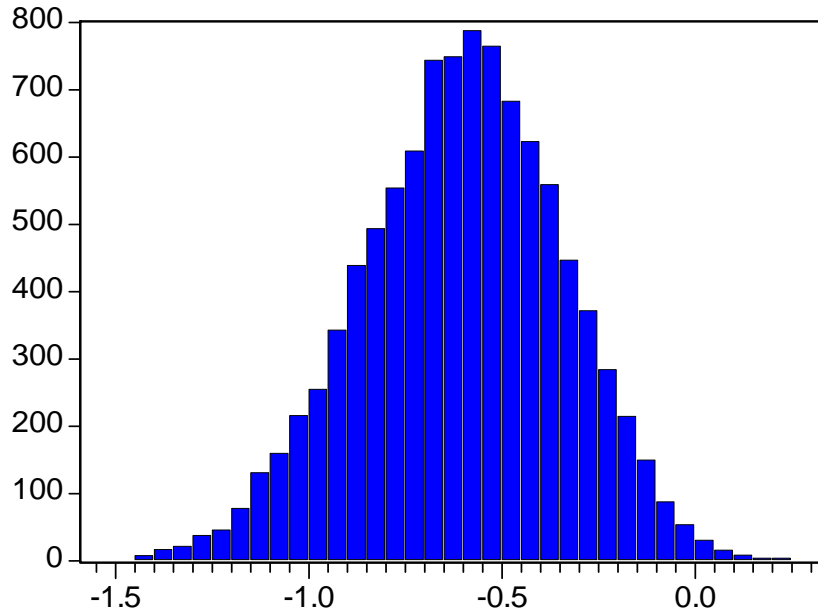
Table 4.3

Empirical Distribution Test for RATIOBEN				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.461021	46.15790	0.0000	
Kolmogorov (D-)	0.457601	45.81556	0.0000	
Kolmogorov (D)	0.461021	46.15790	0.0000	
Kuiper (V)	0.918622	92.00681	0.0000	
Cramer-von Mises (W2)	757.3516	757.4273	0.0000	
Watson (U2)	757.3516	757.4122	0.0000	
Anderson-Darling (A2)	3558.823	3558.823	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.056375	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9195.405	Mean dependent var.		-0.056375
No. of Coefficients	0	S.D. dependent var.		0.034699
* Fixed parameter value				

4.4 Net exports to GDP ratio

4.4.1 Bootstrapped coefficient in the West African countries saving regression

Figure 4.4: EDF of the coefficient for the Net Exports to GDP ratio in West Africa

4.4.2 Results of the empirical distribution test for the net exports to GDP ratio coefficient in the West African countries saving regression
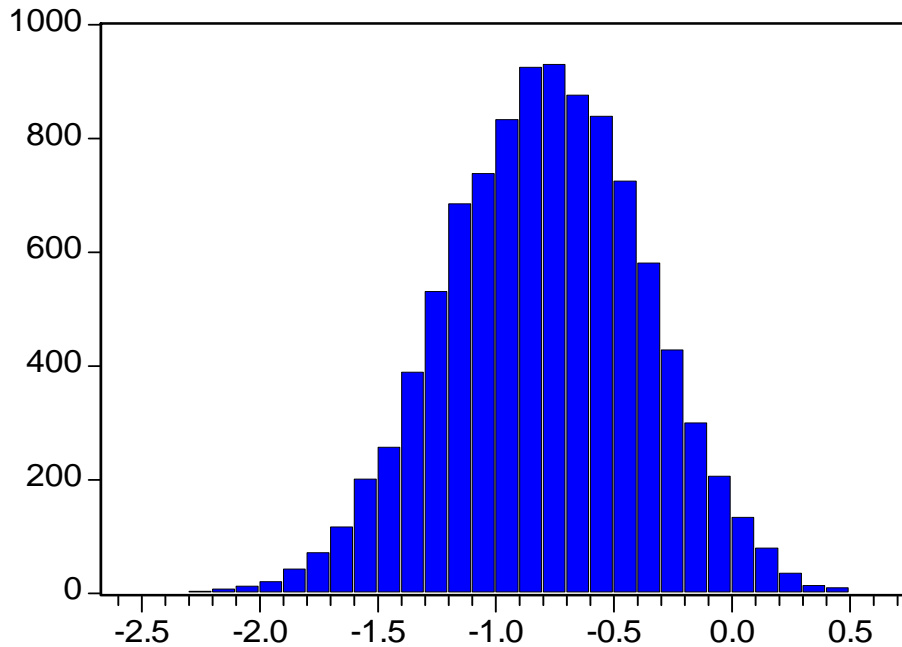
Table 4.4

Empirical Distribution Test for RATIONX				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.290382	29.07341	0.0000	
Kolmogorov (D-)	0.277596	27.79324	0.0000	
Kolmogorov (D)	0.290382	29.07341	0.0000	
Kuiper (V)	0.567979	56.88727	0.0000	
Cramer-von Mises (W2)	362.0563	362.0924	0.0000	
Watson (U2)	362.0560	362.0850	0.0000	
Anderson-Darling (A2)	1921.968	1921.968	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.602720	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9530.980	Mean dependent var.		-0.602720
No. of Coefficients	0	S.D. dependent var.		0.261392
* Fixed parameter value				

4.5 Government deficit to GDP ratio

4.5.1 Bootstrapped coefficient in the West African countries saving regression

Figure 4.5: EDF of the coefficient for the Government deficit to GDP ratio in West Africa

4.5.2 Results of the empirical distribution test for the government deficit to GDP ratio coefficient in the West African countries saving regression
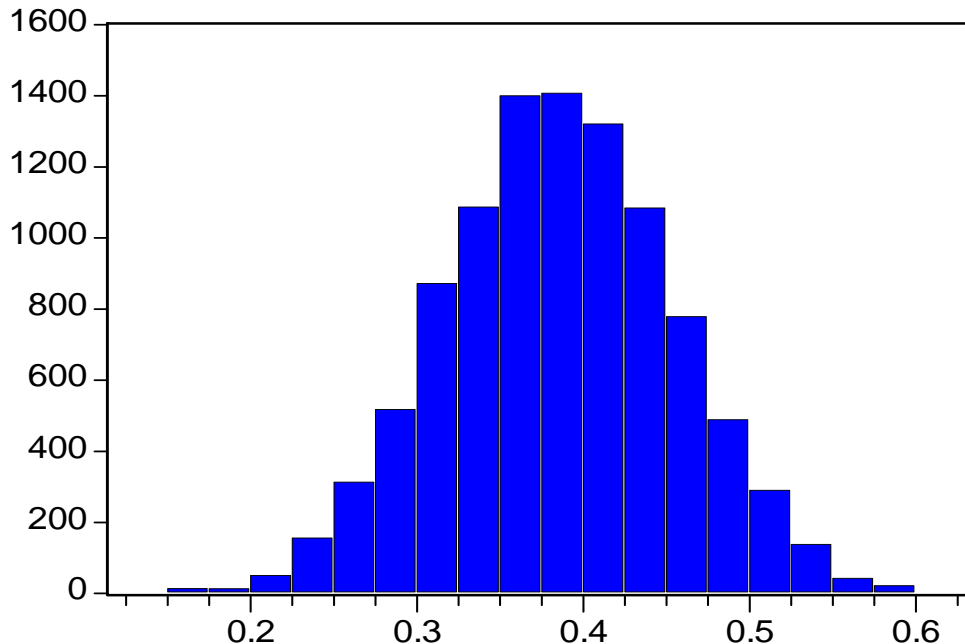
Table 4.5

Empirical Distribution Test for RDEF				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.201289	20.15329	0.0000	
Kolmogorov (D-)	0.197612	19.78514	0.0000	
Kolmogorov (D)	0.201289	20.15329	0.0000	
Kuiper (V)	0.398901	39.95292	0.0000	
Cramer-von Mises (W2)	188.2935	188.3123	0.0000	
Watson (U2)	188.2923	188.3074	0.0000	
Anderson-Darling (A2)	1114.529	1114.529	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.789063	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-10070.74	Mean dependent var.		-0.789063
No. of Coefficients	0	S.D. dependent var.		0.419867
* Fixed parameter value				

4.6 Government consumption to GDP ratio

4.6.1 Bootstrapped coefficient in the West African countries saving regression

Figure 4.6: EDF of the coefficient for the Government Consumption to GDP ratio in West Africa

4.6.2 Results of the empirical distribution test for the government consumption to GDP ratio coefficient in the West African countries saving regression

Table 4.6

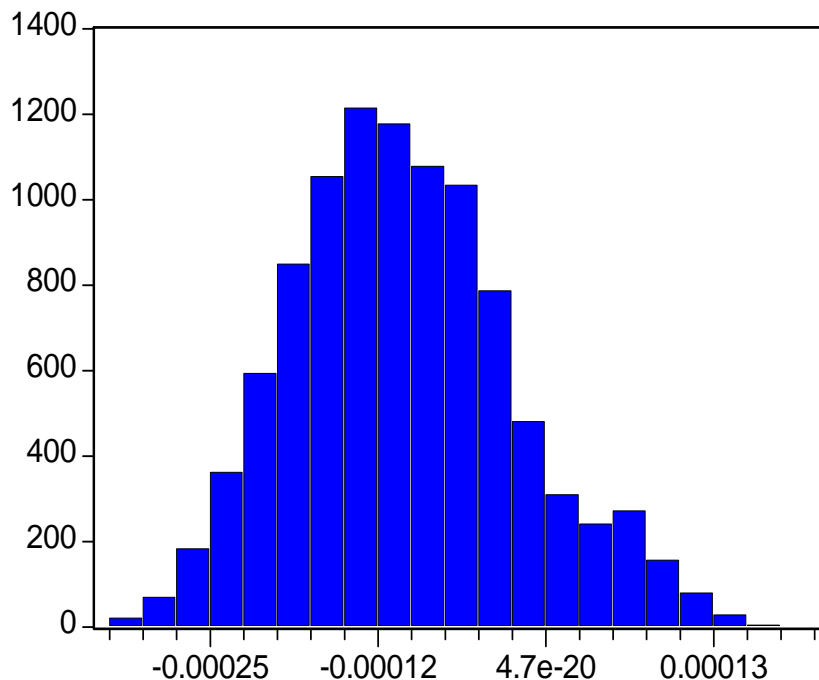| Empirical Distribution Test for RGCONS			
Hypothesis: Normal			
Sample: 1 10000			
Included observations: 10000			
Method	Value	Adj. Value	Probability
Kolmogorov (D+)	0.428404	42.89232	0.0000
Kolmogorov (D-)	0.428487	42.90055	0.0000
Kolmogorov (D)	0.428487	42.90055	0.0000
Kuiper (V)	0.856891	85.82397	0.0000
Cramer-von Mises (W2)	686.2152	686.2838	0.0000
Watson (U2)	686.2152	686.2701	0.0000
Anderson-Darling (A2)	3273.093	3273.093	0.0000
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	0.385430	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9212.929	Mean dependent var.		0.385430
No. of Coefficients	0	S.D. dependent var.		0.068624
* Fixed parameter value			

Annexure 5: Growth Regression in SADC Countries

5.1 Inflation

5.1.1 Bootstrapped coefficient in the SADC growth regression

The results of the bootstrapped coefficient of inflation show that the coefficients are right hand skewed with a mean -0.000105, implying that the reliance on the standard normal assumptions may lead to wrong conclusions on the validity of the results. The results above show that Jarque-Bera test is 222.1909 with p-value = 0.00000, rejecting the standard normality assumptions and therefore the bootstrapped results are preferable. This approach was used in analysing all the results present in this study.

Figure 5.1: EDF of the coefficient for Inflation in SADC

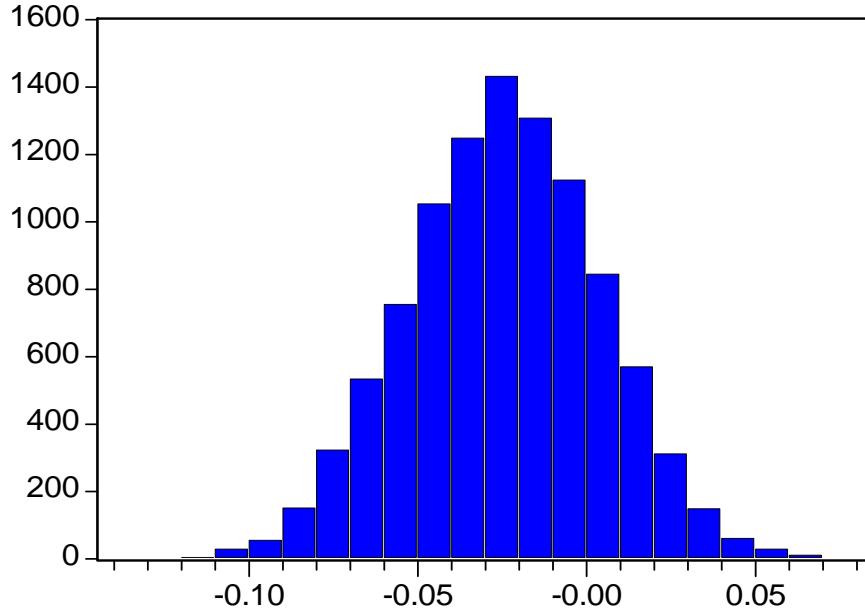### 5.1.1 Results of the empirical distribution tests for the inflation coefficient in the SADC growth regression

The results of the empirical distribution test on the inflation reject the standard normality ($\mu=0$ and $\sigma=1$) but the normality do not passes the test for empirical normal distribution coefficient for inflation. This test justifies even further the use of bootstrapping of the LSDV regression results.

5.2 Openness

5.2.1 Bootstrapped coefficient in the SADC growth regression

Figure 5.2: EDF of the coefficient for Openness in SADC

5.2.1 Results of the empirical distribution tests for the openness coefficient in the SADC growth regression
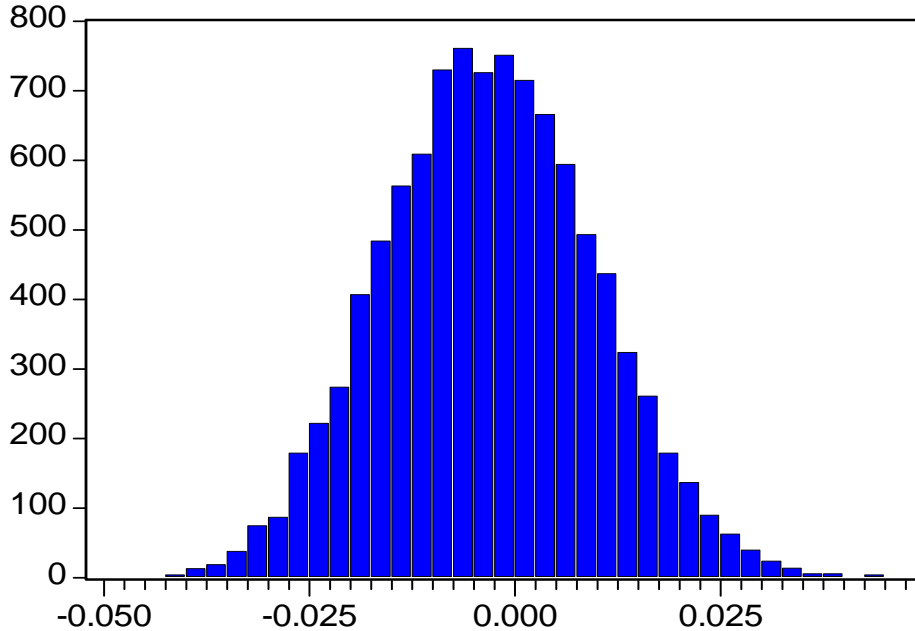
Table 5.1

Empirical Distribution Test for OPENNESS				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.466523	46.70875	0.0000	
Kolmogorov (D-)	0.466656	46.72210	0.0000	
Kolmogorov (D)	0.466656	46.72210	0.0000	
Kuiper (V)	0.933178	93.46472	0.0000	
Cramer-von Mises (W2)	770.7211	770.7982	0.0000	
Watson (U2)	770.7211	770.7828	0.0000	
Anderson-Darling (A2)	3612.392	3612.392	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.024359	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9193.398	Mean dependent var.		-0.024359
No. of Coefficients	0	S.D. dependent var.		0.028330
* Fixed parameter value				

5.3 Benefit payments to GDP ratio

5.3.1 Bootstrapped coefficient in the SADC growth regression

Figure 5.3: EDF of the coefficient for the Benefit Payments to GDP ratio in SADC

5.3.1 Results of the empirical distribution tests for benefit payments to GDP ratio coefficient in the SADC growth regression

Table 5.2

Empirical Distribution Test for RATIOBEN				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.427505	42.80232	0.0000	
Kolmogorov (D-)	0.415935	41.64387	0.0000	
Kolmogorov (D)	0.427505	42.80232	0.0000	
Kuiper (V)	0.843440	84.47680	0.0000	
Cramer-von Mises (W2)	676.7850	676.8526	0.0000	
Watson (U2)	676.5065	676.5606	0.0000	
Anderson-Darling (A2)	565236.4	565236.4	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.003010	*	NA	NA
SIGMA	0.001000	*	NA	NA
Log likelihood	NA	Mean dependent var.		-0.003010
No. of Coefficients	0	S.D. dependent var.		0.012856
	* Fixed parameter value			

5.4 Investment to GDP ratio

5.4.1 Bootstrapped coefficient in the SADC growth regression

Figure 5.4: EDF of the coefficient for the Investment to GDP ratio in SADC

5.4.1 Results of the empirical distribution tests for investment to GDP ratio coefficient in the SADC growth regression
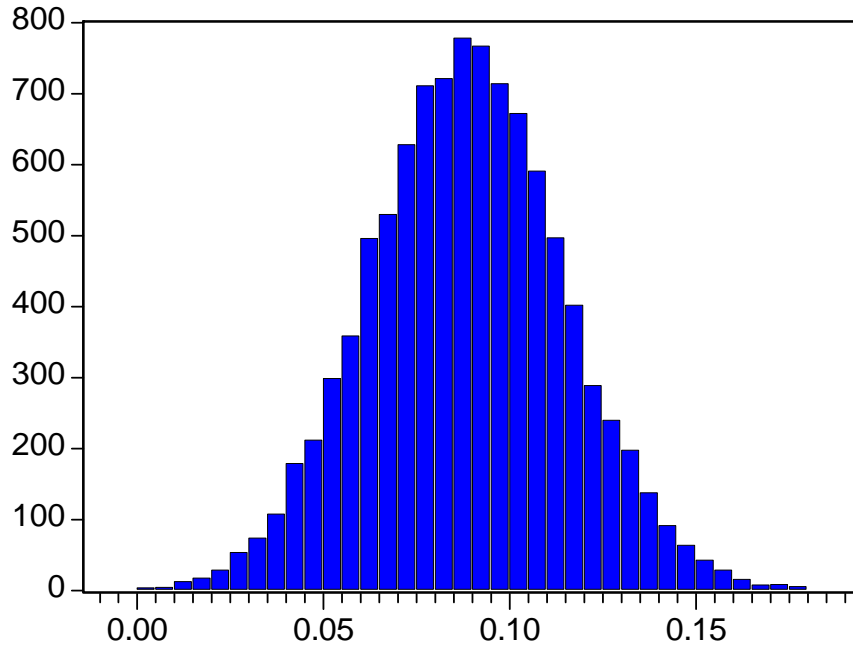
Table 5.3

Empirical Distribution Test for RATIOINV				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.455513	45.60644	0.0000	
Kolmogorov (D-)	0.453918	45.44674	0.0000	
Kolmogorov (D)	0.455513	45.60644	0.0000	
Kuiper (V)	0.909431	91.08619	0.0000	
Cramer-von Mises (W2)	745.0039	745.0783	0.0000	
Watson (U2)	744.9940	745.0536	0.0000	
Anderson-Darling (A2)	1262278.	1262278.	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	0.088627	*	NA	NA
SIGMA	0.001000	*	NA	NA
Log likelihood	NA	Mean dependent var.		0.088627
No. of Coefficients	0	S.D. dependent var.		0.026323
* Fixed parameter value				

5.5 Government consumption to GDP ratio

5.5.1 Bootstrapped coefficient in the SADC growth regression

Figure 5.5: EDF of the coefficient for the Government Consumption to GDP ratio in SADC

5.5.1 Results of the empirical distribution tests for investment to GDP ratio coefficient in the SADC growth regression
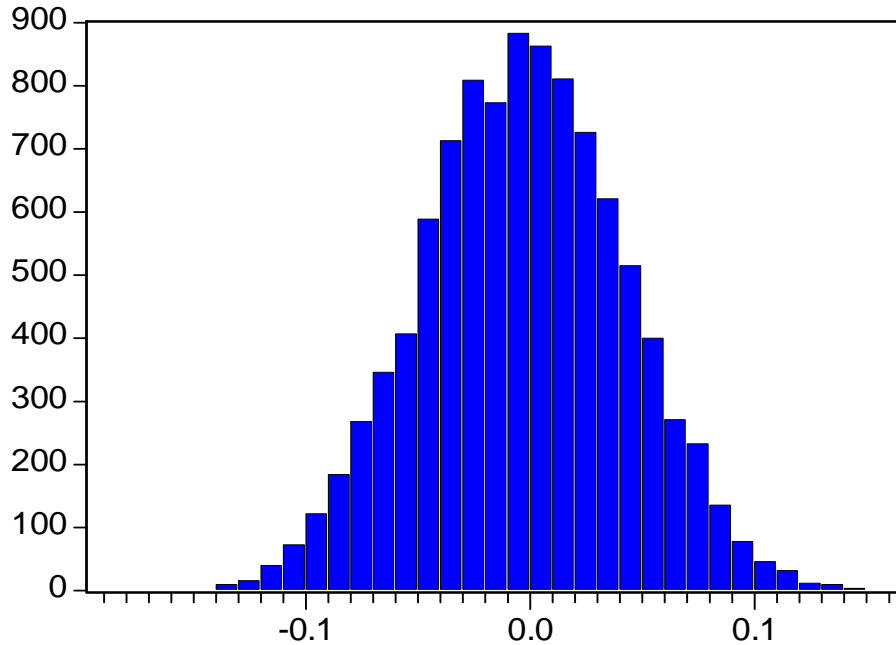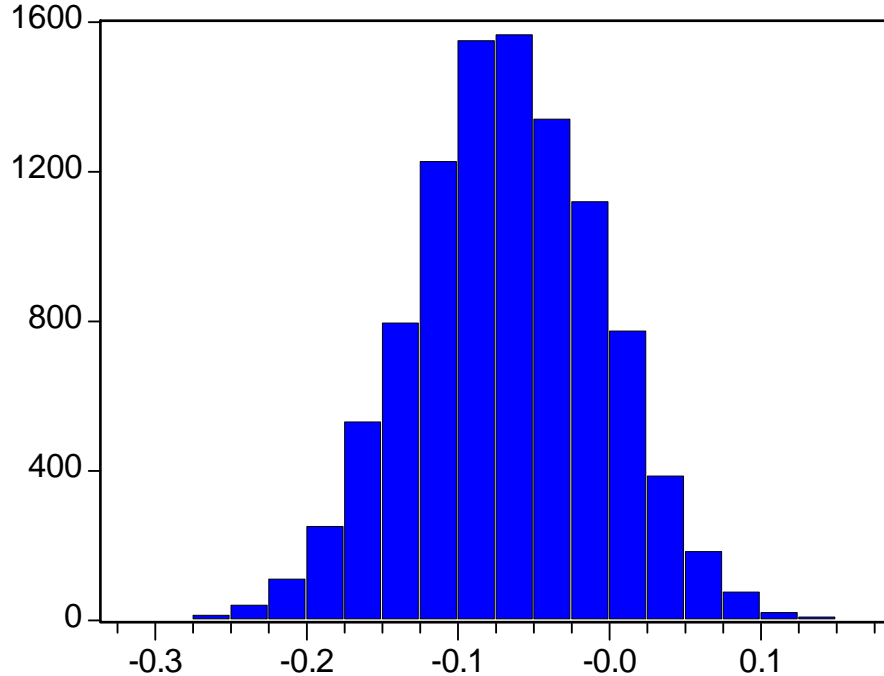
Table 5.4

Empirical Distribution Test for RGCONS				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.449596	45.01409	0.0000	
Kolmogorov (D-)	0.450470	45.10158	0.0000	
Kolmogorov (D)	0.450470	45.10158	0.0000	
Kuiper (V)	0.900067	90.14834	0.0000	
Cramer-von Mises (W2)	734.6809	734.7544	0.0000	
Watson (U2)	734.6809	734.7397	0.0000	
Anderson-Darling (A2)	3467.926	3467.926	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.002870	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9199.600	Mean dependent var.		-0.002870
No. of Coefficients	0	S.D. dependent var.		0.045202
* Fixed parameter value				

5.6 Secondary school enrolment

5.6.1 Bootstrapped coefficient in the SADC growth regression

Figure 5.6: EDF of the coefficient for the Secondary School Enrolment in SADC

5.6.1 Results of the empirical distribution tests for investment to GDP ratio coefficient in the SADC growth regression

Table5.5

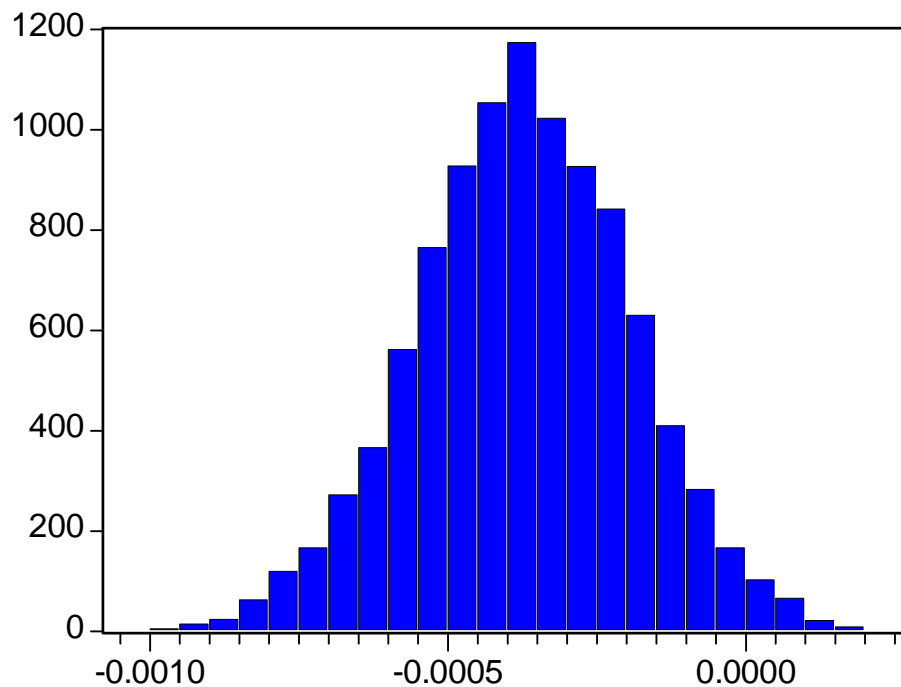| Empirical Distribution Test for SECENR				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.433506	43.40309	0.0000	
Kolmogorov (D-)	0.432088	43.26108	0.0000	
Kolmogorov (D)	0.433506	43.40309	0.0000	
Kuiper (V)	0.865593	86.69559	0.0000	
Cramer-von Mises (W2)	698.9899	699.0598	0.0000	
Watson (U2)	698.9899	699.0458	0.0000	
Anderson-Darling (A2)	3324.511	3324.511	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.067170	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9208.889	Mean dependent var.		-0.067170
No. of Coefficients	0	S.D. dependent var.		0.062460
* Fixed parameter value				

Annexure 6: Growth Regression in West African Countries

6.1 Inflation

6.1.1 Bootstrapped coefficient in the West African growth regression

The results of the bootstrapped coefficient in the inflation show that the coefficient is right hand skewed with a mean -0.000372, implying that the reliance on the standard normal assumptions may lead to wrong conclusions on the validity of the results. The results above show that Jarque-Bera test is 6.8339 with p-value = 0.0328, rejecting the standard normality assumptions and therefore the bootstrapped results are preferable. This approach was used in analysing all the results present in this study.

Figure 6.1: EDF of the coefficient for Inflation in West Africa

6.1.2 Results of the empirical distribution test for the inflation coefficient in the West African growth regression

The results of the empirical distribution test on the inflation reject the standard normality ($\mu=0$ and $\sigma=1$) but the normality passes for $\mu=$ -0.000372 and $\sigma=0.0010$ values based on the results shown in figure 8.1. This test justifies even further the use of bootstrapping of the LSDV regression results.
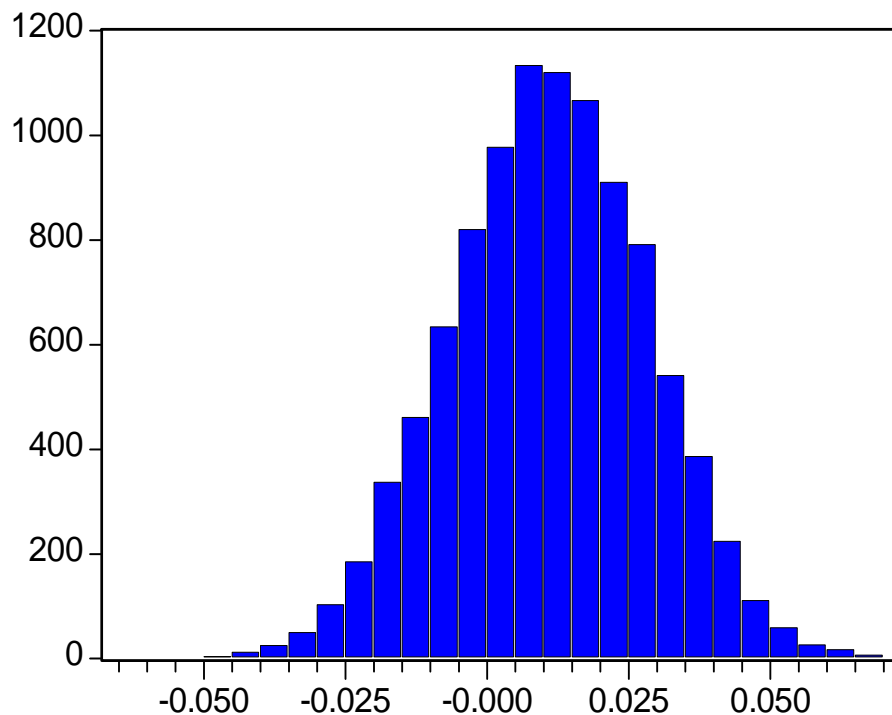
Table 6.1

Empirical Distribution Test for INFL				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.337809	33.82180	0.0000	
Kolmogorov (D-)	0.333108	33.35113	0.0000	
Kolmogorov (D)	0.337809	33.82180	0.0000	
Kuiper (V)	0.670917	67.19729	0.0000	
Cramer-von Mises (W2)	482.1871	482.2353	0.0000	
Watson (U2)	482.1870	482.2256	0.0000	
Anderson-Darling (A2)	2436.562	2436.562	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.000372	*	NA	NA
SIGMA	0.001000	*	NA	NA
Log likelihood	59724.12	Mean dependent var.		-0.000372
No. of Coefficients	0	S.D. dependent var.		0.000181
	* Fixed parameter value			

6.2 Openness

6.2.1 Bootstrapped coefficient in the West African growth regression

Figure 6.2: EDF of the coefficient for Openness in West Africa

6.2.2 Results of the empirical distribution test for the openness coefficient in the West African growth regression
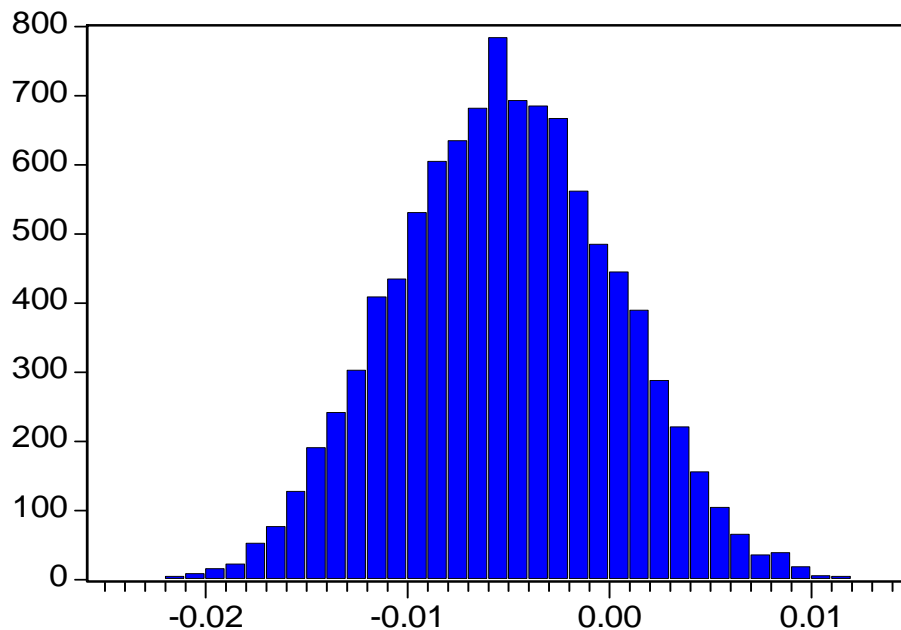
Table 6.2

Empirical Distribution Test for OPENNESS				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.010029	1.004117	0.1331	
Kolmogorov (D-)	0.012710	1.272583	0.0392	
Kolmogorov (D)	0.012710	1.272583	0.0784	
Kuiper (V)	0.022739	2.277526	0.0012	
Cramer-von Mises (W2)	0.389690	0.389689	0.0769	
Watson (U2)	0.369109	0.369129	0.0014	
Anderson-Darling (A2)	2.847403	2.847403	0.0327	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	0.011004	*	NA	NA
SIGMA	0.017000	*	NA	NA
Log likelihood	26322.14	Mean dependent var.		0.011004
No. of Coefficients	0	S.D. dependent var.		0.017394
	* Fixed parameter value			

6.3 Benefit payments to GDP ratio

6.3.1 Bootstrapped coefficient in the West African growth regression

Figure 6.3: EDF of the coefficient for the Benefit Payments to GDP ratio in West Africa

6.3.2 Results of the empirical distribution test for the benefit payment to GDP ratio coefficient in the West African growth regression

Table 6.3

Empirical Distribution Test for RATIOBEN				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.144975	14.51510	0.0000	
Kolmogorov (D-)	0.143864	14.40381	0.0000	
Kolmogorov (D)	0.144975	14.51510	0.0000	
Kuiper (V)	0.288839	28.92939	0.0000	
Cramer-von Mises (W2)	102.1746	102.1848	0.0000	
Watson (U2)	102.1744	102.1826	0.0000	
Anderson-Darling (A2)	665.9145	665.9145	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.005131	*	NA	NA
SIGMA	0.010000	*	NA	NA
Log likelihood	35419.96	Mean dependent var.		-0.005131
No. of Coefficients	0	S.D. dependent var.		0.005371
	* Fixed parameter value			

6.4 Investment to GDP ratio

6.4.1 Bootstrapped coefficient in the West African growth regression

Figure 6.4: EDF of the coefficient for the Investment to GDP ratio in West Africa

6.4.2 Results of the empirical distribution test for the investment to GDP ratio coefficient in the West African growth regression
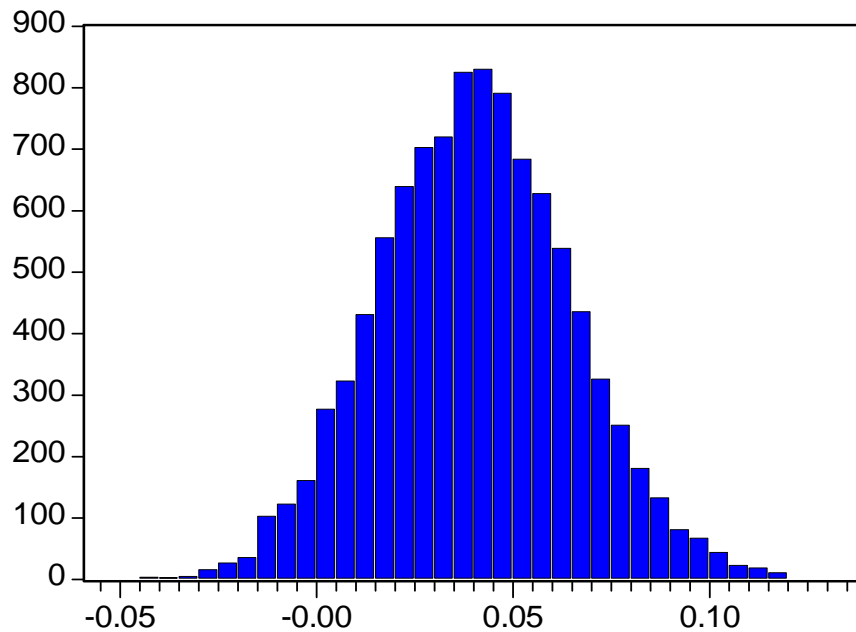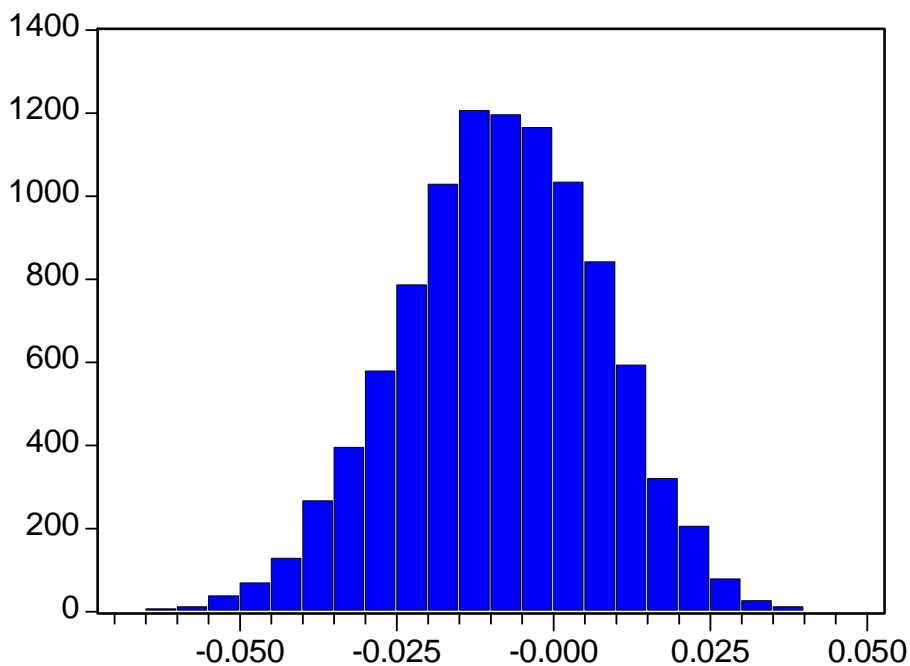
Table 6.4

Empirical Distribution Test for RATIOINV				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.291123	29.14752	0.0000	
Kolmogorov (D-)	0.295603	29.59612	0.0000	
Kolmogorov (D)	0.295603	29.59612	0.0000	
Kuiper (V)	0.586726	58.76494	0.0000	
Cramer-von Mises (W2)	383.2492	383.2875	0.0000	
Watson (U2)	383.2491	383.2798	0.0000	
Anderson-Darling (A2)	2013.988	2013.988	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	0.040413	*	NA	NA
SIGMA	0.100000	*	NA	NA
Log likelihood	13532.48	Mean dependent var.		0.040413
No. of Coefficients	0	S.D. dependent var.		0.024658
* Fixed parameter value				

6.5 Government consumption to GDP ratio

6.5.1 Bootstrapped coefficient in the West African growth regression

Figure 6.5: EDF of the coefficient for the Government Consumption to GDP ratio in West Africa

6.5.2 Results of the empirical distribution test for government consumption to GDP ratio coefficient in the West African growth regression

Table 6.5

Empirical Distribution Test for RGCONS				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.358452	35.88859	0.0000	
Kolmogorov (D-)	0.350699	35.11233	0.0000	
Kolmogorov (D)	0.358452	35.88859	0.0000	
Kuiper (V)	0.709150	71.02666	0.0000	
Cramer-von Mises (W2)	517.7664	517.8181	0.0000	
Watson (U2)	517.7664	517.8078	0.0000	
Anderson-Darling (A2)	2585.780	2585.780	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.008346	*	NA	NA
SIGMA	0.100000	*	NA	NA
Log likelihood	13710.31	Mean dependent var.		-0.008346
No. of Coefficients	0	S.D. dependent var.		0.015885
* Fixed parameter value				

6.6 Secondary School Enrolment

6.6.1 Bootstrapped coefficient in the West African growth regression

Figure 6.6: EDF of the coefficient for Secondary School Enrolment in West Africa

6.6.2 Results of the empirical distribution test for government consumption to GDP ratio coefficient in the West African growth regression
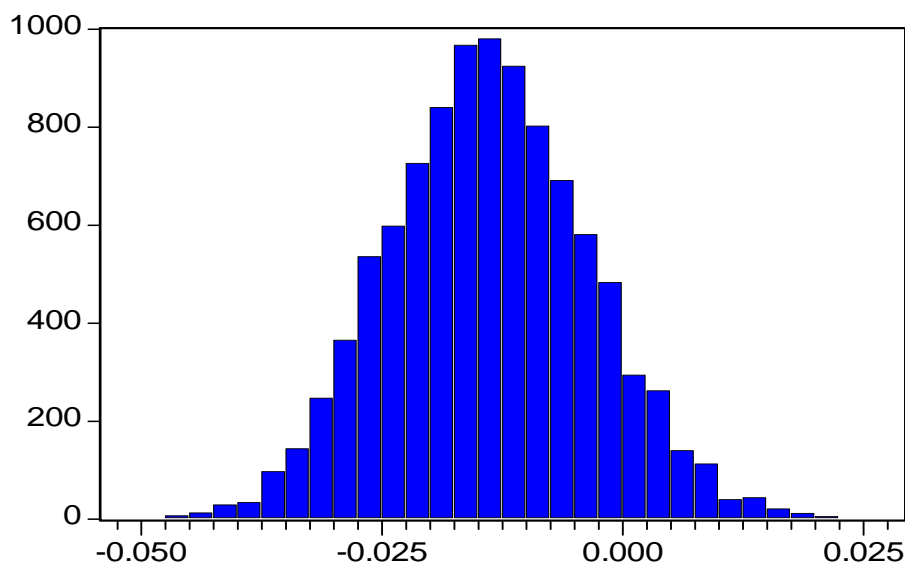
Table 6.6

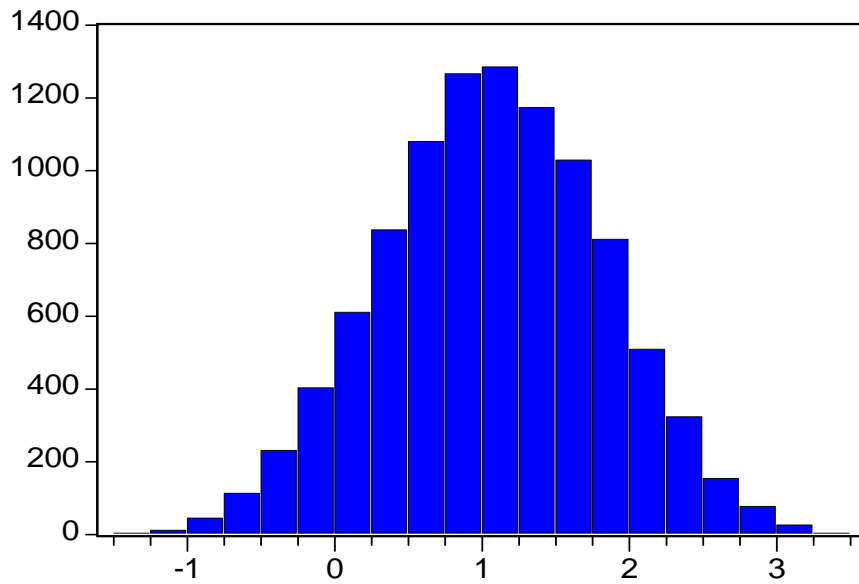| Empirical Distribution Test for SECENR				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.016203	1.622311	0.0052	
Kolmogorov (D-)	0.014316	1.433333	0.0164	
Kolmogorov (D)	0.016203	1.622311	0.0104	
Kuiper (V)	0.030519	3.056751	0.0000	
Cramer-von Mises (W2)	0.863673	0.863719	0.0052	
Watson (U2)	0.796164	0.796218	0.0000	
Anderson-Darling (A2)	7.563023	7.563023	0.0003	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.013827	*	NA	NA
SIGMA	0.010000	*	NA	NA
Log likelihood	31384.43	Mean dependent var.		-0.013827
No. of Coefficients	0	S.D. dependent var.		0.010468
* Fixed parameter value				

Annexure 7: Fertility Regression in SADC Countries

7.1 Per capita GDP growth

7.1.1 Bootstrapped coefficient in the SADC fertility regression

The results of the bootstrapped coefficient in the growth of per capita GDP show that the coefficients are left hand skewed with a mean one, implying that the reliance on the standard normal assumptions may lead to wrong conclusions on the validity of the results. The results above show that Jarque-Bera test is 27.3155 with p-value = 0.00000, rejecting the standard normality assumptions and therefore the bootstrapped results are preferable. This approach was used in analysing all the results present in this study.

Figure 7.1: EDF of the coefficient for Per Capita GDP Growth in SADC

7.1.2 Results of the empirical distribution tests for GDPPC in the SADC fertility regression

The results of the empirical distribution test on the growth of per capita GDP reject the standard normality (μ=0 and σ=1) but the normality passes for μ=1 and σ=1 values based on the results shown in figure 9.1. This test justifies even further the use of bootstrapping of the LSDV regression results.
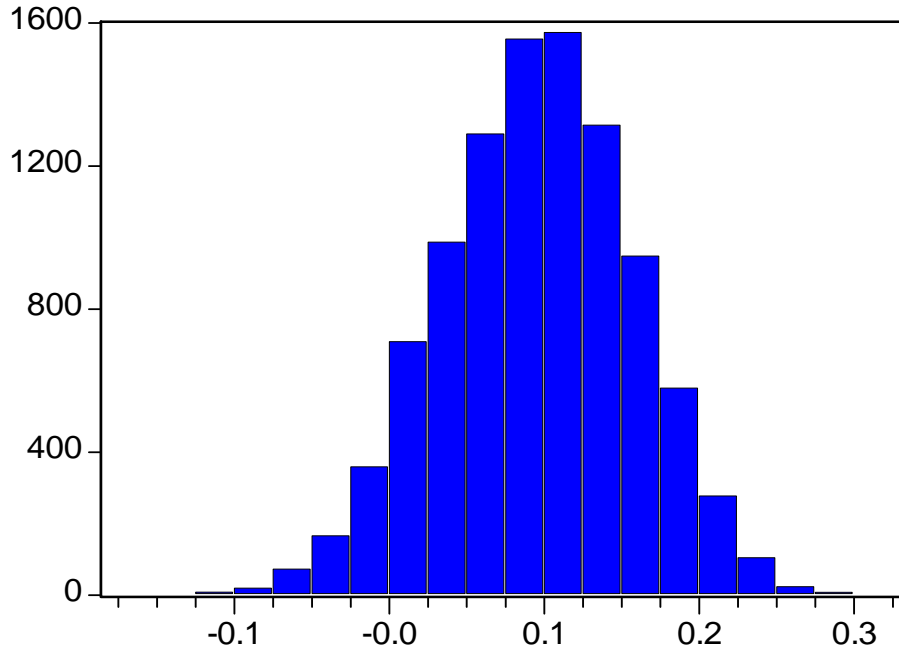
Table 7.1

Empirical Distribution Test for GGDPPC					
Hypothesis: Normal					
Sample: 1 10000					
Included observations: 10000					
Method	Value	Adj. Value	Probability		
Kolmogorov (D+)	0.050597	5.065786	0.0000		
Kolmogorov (D-)	0.085680	8.578390	0.0000		
Kolmogorov (D)	0.085680	8.578390	0.0000		
Kuiper (V)	0.136277	13.64912	0.0000		
Cramer-von Mises (W2)	28.47549	28.47830	0.0000		
Watson (U2)	22.80651	22.80832	0.0000		
Anderson-Darling (A2)	199.0130	199.0130	0.0000		
Parameter	Value	Std. Error	z-Statistic		Prob.
MU	1.000000	*	NA		NA
SIGMA	1.000000	*	NA		NA
Log likelihood	-12036.12	Mean dependent var.			1.072872
No. of Coefficients	0	S.D. dependent var.			0.751062
* Fixed parameter value					

7.2 Benefit payments to GDP ratio

7.2.1 Bootstrapped coefficient in the SADC fertility regression

Figure 7.2: EDF of the coefficient for the Benefit Payments to GDP ratio in SADC

7.2.2 Results of the empirical distribution tests for benefit payments to GDP ratio in the SADC fertility regression
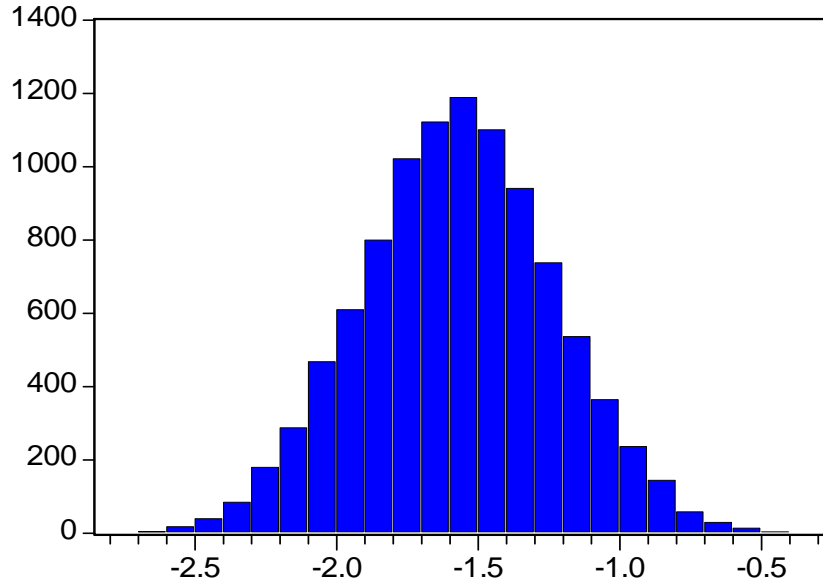
Table 7.2

Empirical Distribution Test for RATIOBEN				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.438478	43.90094	0.0000	
Kolmogorov (D-)	0.430202	43.07230	0.0000	
Kolmogorov (D)	0.438478	43.90094	0.0000	
Kuiper (V)	0.868680	87.00477	0.0000	
Cramer-von Mises (W2)	700.3126	700.3826	0.0000	
Watson (U2)	700.2848	700.3408	0.0000	
Anderson-Darling (A2)	3329.836	3329.836	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	0.100000	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9208.535	Mean dependent var.		0.095806
No. of Coefficients	0	S.D. dependent var.		0.061748
* Fixed parameter value				

7.3 Net exports to GDP ratio

7.3.1 Bootstrapped coefficient in the SADC fertility regression

Figure 7.3: EDF of the coefficient for the Net Exports to GDP ratio in SADC

7.3.2 Results of the empirical distribution tests for net exports to GDP ratio in the SADC fertility regression
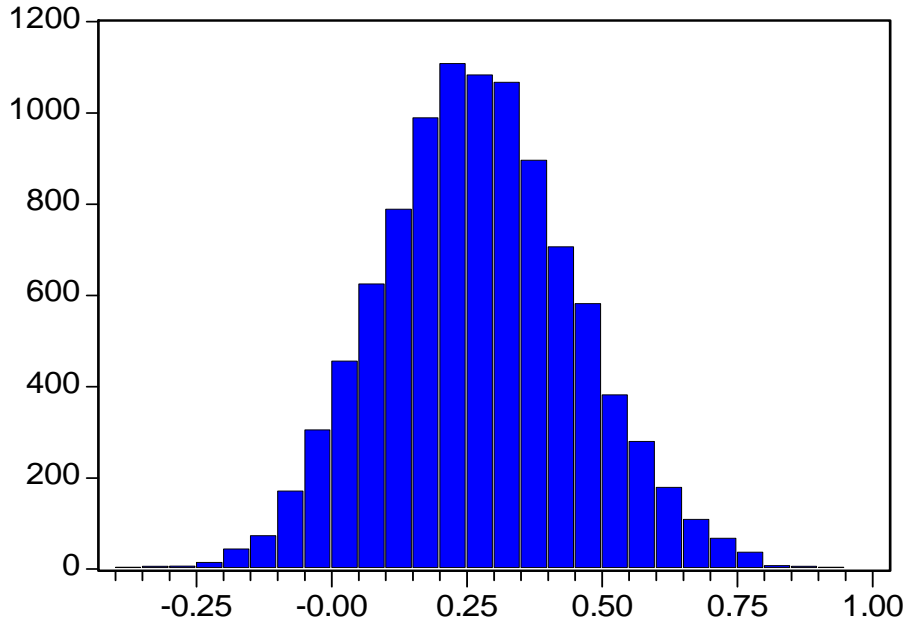
Table 7.3

Empirical Distribution Test for RATIONX				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.261557	26.18739	0.0000	
Kolmogorov (D-)	0.212702	21.29592	0.0000	
Kolmogorov (D)	0.261557	26.18739	0.0000	
Kuiper (V)	0.474259	47.50053	0.0000	
Cramer-von Mises (W2)	273.4620	273.4893	0.0000	
Watson (U2)	266.3926	266.4139	0.0000	
Anderson-Darling (A2)	1514.125	1514.125	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-1.500000	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9794.535	Mean dependent var.		-1.570432
No. of Coefficients	0	S.D. dependent var.		0.340706
* Fixed parameter value				

7.4 Government consumption to GDP ratio

7.4.1 Bootstrapped coefficient in the SADC fertility regression

Figure 7.4: EDF of the coefficient for the Government Consumption to GDP ratio in SADC

7.4.2 Results of the empirical distribution tests for government consumption to GDP ratio in the SADC fertility regression
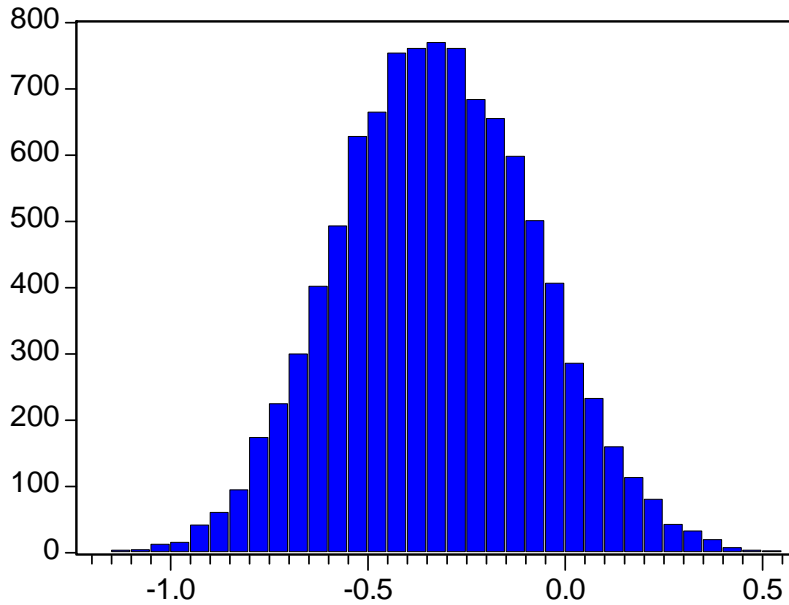
Table 7.4

Empirical Distribution Test for RGCONS				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.323825	32.42174	0.0000	
Kolmogorov (D-)	0.351889	35.23156	0.0000	
Kolmogorov (D)	0.351889	35.23156	0.0000	
Kuiper (V)	0.675715	67.67782	0.0000	
Cramer-von Mises (W2)	482.5658	482.6140	0.0000	
Watson (U2)	481.7336	481.7721	0.0000	
Anderson-Darling (A2)	2437.582	2437.582	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	0.250000	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9356.667	Mean dependent var.		0.273362
No. of Coefficients	0	S.D. dependent var.		0.181422
* Fixed parameter value				

7.5 Secondary school enrolment

7.5.1 Bootstrapped coefficient in the SADC fertility regression

Figure 7.5: Secondary School Enrolment

7.5.2 Results of the empirical distribution tests for secondary school enrolment in the SADC fertility regression

Table 7.5

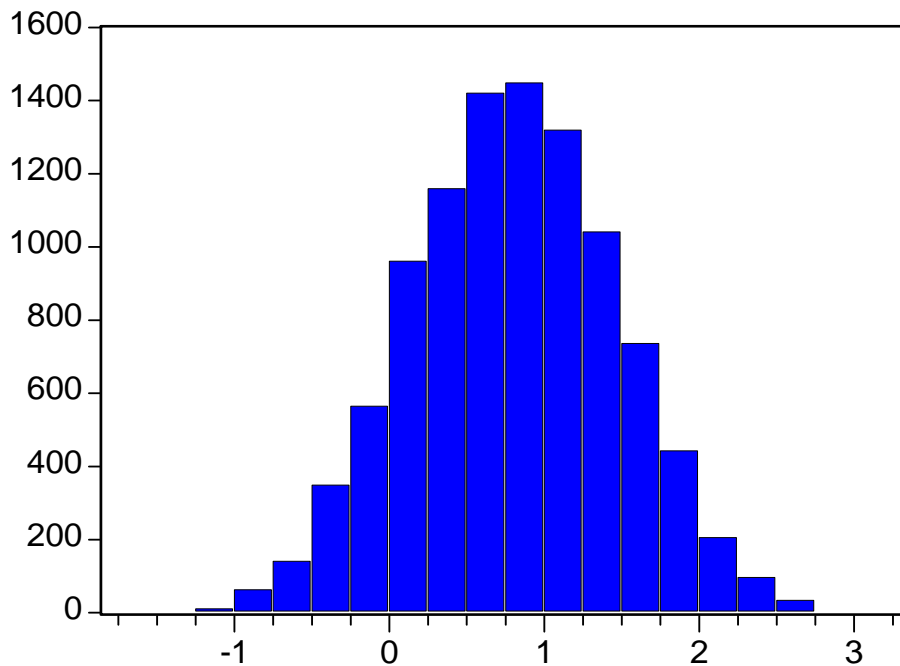| Empirical Distribution Test for SECENR				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.298450	29.88110	0.0000	
Kolmogorov (D-)	0.287180	28.75282	0.0000	
Kolmogorov (D)	0.298450	29.88110	0.0000	
Kuiper (V)	0.585630	58.65517	0.0000	
Cramer-von Mises (W2)	378.7547	378.7925	0.0000	
Watson (U2)	377.9946	378.0249	0.0000	
Anderson-Darling (A2)	1995.502	1995.502	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.300000	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9501.621	Mean dependent var.		-0.322363
No. of Coefficients	0	S.D. dependent var.		0.248904
* Fixed parameter value				

Annexure 8: Fertility Regression in West African Countries

8.1 Per capita GDP growth

8.1.1 Bootstrapped coefficient in the West African fertility regression

The results of the bootstrapped coefficient in the growth of per capita GDP show that the coefficients are left hand skewed with a mean one, implying that the reliance on the standard normal assumptions may lead to wrong conclusions on the validity of the results. The results above shows that Jarque-Bera test is 27.0569 with p-value = 0.00000, rejecting the standard normality assumptions and therefore the bootstrapped results are preferable. This approach was used in analysing all the results present in this study.

Figure 8.1: EDF of the coefficient for Per Capita GDP Growth in West Africa

8.1.1 Results of the empirical distribution tests for GGDPPC in the West African fertility regression

The results of the empirical distribution test on the growth of per capita GDP reject the standard normality ($\mu=0$ and $\sigma=1$) but the normality passes for $\mu= 0.8049$ and $\sigma=1$ values based on the results shown in figure 11.1. This test justifies even further the use of bootstrapping of the LSDV regression results.
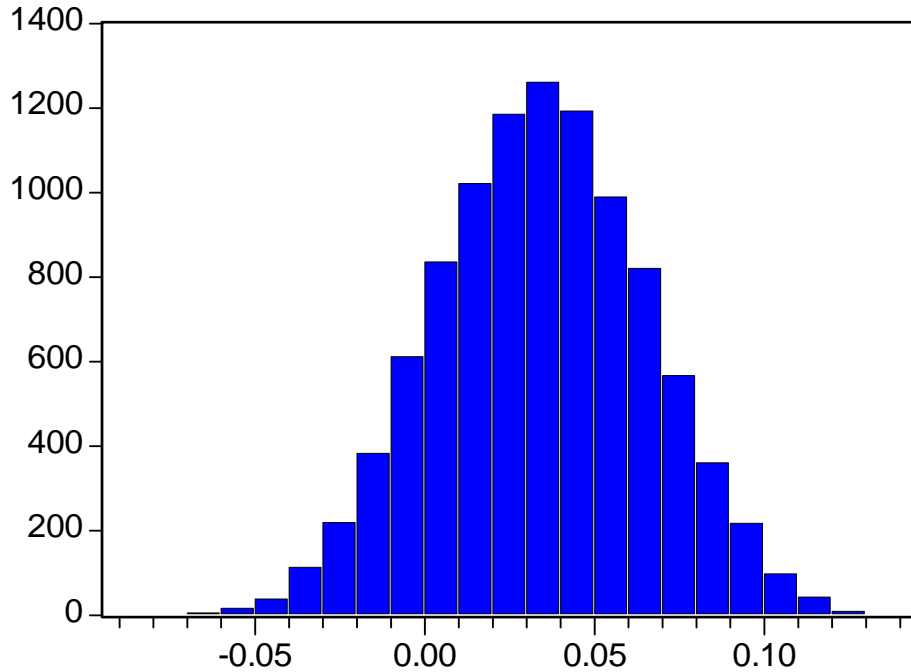
Table 8.1

Empirical Distribution Test for GGDPPC				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.097574	9.769225	0.0000	
Kolmogorov (D-)	0.097745	9.786350	0.0000	
Kolmogorov (D)	0.097745	9.786350	0.0000	
Kuiper (V)	0.195319	19.56267	0.0000	
Cramer-von Mises (W2)	45.69361	45.69814	0.0000	
Watson (U2)	45.69349	45.69714	0.0000	
Anderson-Darling (A2)	331.9080	331.9080	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	0.804900	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-11376.70	Mean dependent var.		0.804856
No. of Coefficients	0	S.D. dependent var.		0.661443
* Fixed parameter value				

8.2 Benefit payments to GDP ratio

8.2.1 Bootstrapped coefficient in the West African fertility regression

Figure 8.2: EDF of the coefficient for the Benefit Payments to GDP ratio in West Africa

8.2.1 Results of the empirical distribution tests benefit payment to GDP ratio in the West African fertility regression
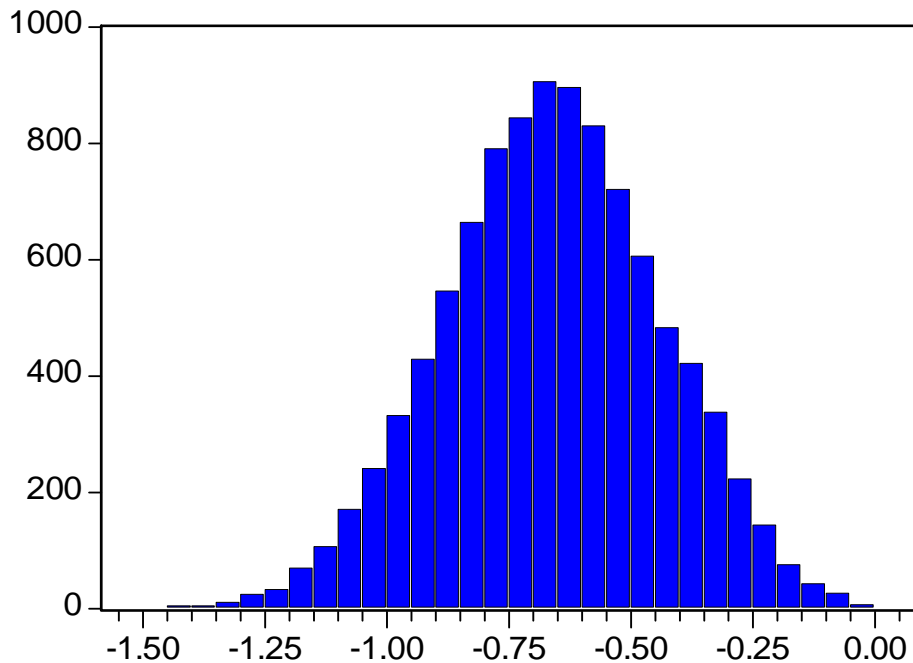
Table 8.2

Empirical Distribution Test for RATIOBEN				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.464897	46.54600	0.0000	
Kolmogorov (D-)	0.465079	46.56427	0.0000	
Kolmogorov (D)	0.465079	46.56427	0.0000	
Kuiper (V)	0.929976	93.14403	0.0000	
Cramer-von Mises (W2)	764.6216	764.6980	0.0000	
Watson (U2)	764.6216	764.6828	0.0000	
Anderson-Darling (A2)	3587.964	3587.964	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	0.034443	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9194.214	Mean dependent var.		0.034431
No. of Coefficients	0	S.D. dependent var.		0.031078
		* Fixed parameter value		

8.3 Net exports to GDP ratio

8.3.1 Bootstrapped coefficient in the West African fertility regression

Figure 8.3: EDF of the coefficient for the Net Exports to GDP ratio in West Africa

8.3.1 Results of the empirical distribution tests for the net exports to GDP ratio in the West African fertility regression
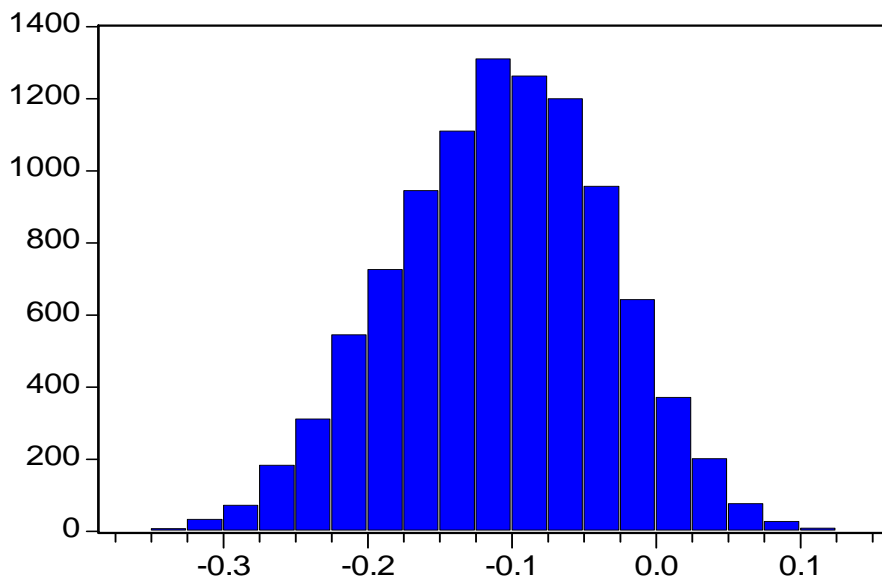
Table 8.3

Empirical Distribution Test for RATIONX				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.310704	31.10805	0.0000	
Kolmogorov (D-)	0.307061	30.74326	0.0000	
Kolmogorov (D)	0.310704	31.10805	0.0000	
Kuiper (V)	0.617765	61.87373	0.0000	
Cramer-von Mises (W2)	416.0030	416.0445	0.0000	
Watson (U2)	416.0029	416.0362	0.0000	
Anderson-Darling (A2)	2156.643	2156.643	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.661426	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9437.505	Mean dependent var.		-0.661426
No. of Coefficients	0	S.D. dependent var.		0.222775
* Fixed parameter value				

8.4 Government consumption to GDP ratio

8.4.1 Bootstrapped coefficient in the West African fertility regression

Figure 8.4: EDF of the coefficient for the Government Consumption to GDP ratio in West Africa

8.4.1 Results of the empirical distribution tests government consumption to GDP ratio in the West African fertility regression
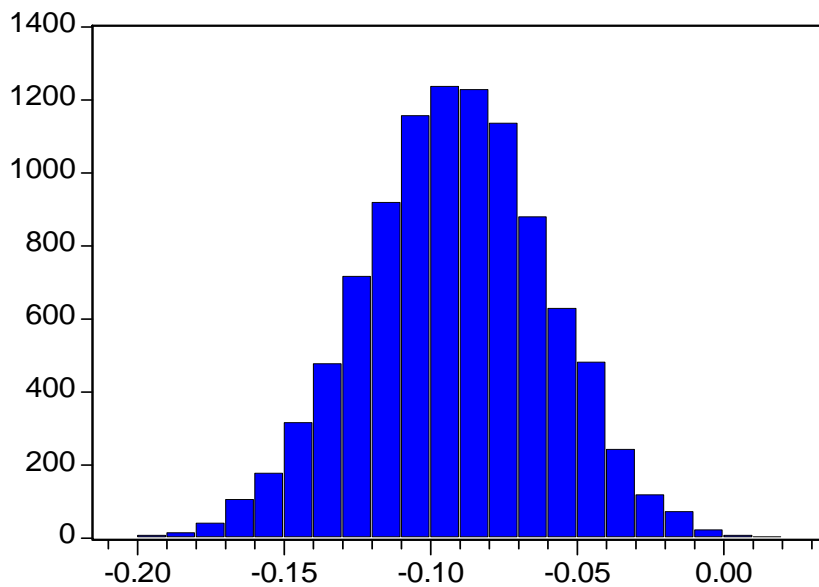
Table 8.4

Empirical Distribution Test for RGCONS				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.426416	42.69327	0.0000	
Kolmogorov (D-)	0.422116	42.26277	0.0000	
Kolmogorov (D)	0.426416	42.69327	0.0000	
Kuiper (V)	0.848533	84.98684	0.0000	
Cramer-von Mises (W2)	674.7023	674.7697	0.0000	
Watson (U2)	674.7023	674.7563	0.0000	
Anderson-Darling (A2)	3226.733	3226.733	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.107058	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9216.854	Mean dependent var.		-0.107058
No. of Coefficients	0	S.D. dependent var.		0.074124
* Fixed parameter value				

8.5 Secondary school enrolment

8.5.1 Bootstrapped coefficient in the West African fertility regression

Figure 8.5: EDF of the coefficient for Secondary School Enrolment in West Africa

8.5.1 Results of the empirical distribution tests for secondary school enrolment in the West African fertility regression

Table 8.5

Empirical Distribution Test for SECENR				
Hypothesis: Normal				
Sample: 1 10000				
Included observations: 10000				
Method	Value	Adj. Value	Probability	
Kolmogorov (D+)	0.463964	46.45257	0.0000	
Kolmogorov (D-)	0.462887	46.34480	0.0000	
Kolmogorov (D)	0.463964	46.45257	0.0000	
Kuiper (V)	0.926851	92.83102	0.0000	
Cramer-von Mises (W2)	763.7816	763.8579	0.0000	
Watson (U2)	763.7816	763.8427	0.0000	
Anderson-Darling (A2)	3584.593	3584.593	0.0000	
Parameter	Value	Std. Error	z-Statistic	Prob.
MU	-0.091714	*	NA	NA
SIGMA	1.000000	*	NA	NA
Log likelihood	-9194.376	Mean dependent var.		-0.091714
No. of Coefficients	0	S.D. dependent var.		0.031595
* Fixed parameter value				