EFFECTS OF PUBLIC PENSION SCHEMES ON NATIONAL SAVINGS IN KENYA, 1971-2011

SALOME WAMBUI THINGURI

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DECLARATION

This research is my original work and has not been presented for award of a degree in any other university.

Signature........Thinguri........ Date........3/05/2013........

Salome Wambui Thinguri
Bsc. Actuarial Science, Jomo Kenyatta University of Agriculture and Technology
K102/12761/2009

This project is submitted with our approval as supervisors:

Signature................................Date........3/5/2013........

Dr. Paul M. Gachanja
Department of Economic Theory
School of Economics
Kenyatta University
Nairobi, Kenya.

Signature................................Date........3/5/13........

DR. Dianah Muchai
Department of Econometrics and Statistics
School of Economics
Kenyatta University
Nairobi, Kenya.

DEDICATION

To Mum, Dad, Angela, Andrew, Faith and Steve. I also dedicate this to Jones Kyalo for his moral support.

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OPERATIONAL DEFINITIONS OF TERMS

Pay-A-You-Go is a type of social security program which shifts income from children who are taxpayers to parents who are beneficiaries.

Funded pension plan is one in which pension obligations are covered, either partially or fully, by assets.

Precautionary savings occurs in response to uncertainty regarding future income.

Gross Domestic Savings (GDS) is the Gross Domestic Product less final consumption calculated on annual basis.

ABBREVIATIONS

PAYG	Pay-As-You-Go
OLG	Overlapping Generations Model
GDP	Gross Domestic Product
GDS	Gross Domestic Savings
OECD	Organization for Economic Cooperation and Development
ECOWAS	Economic Community of West African States
GOK	Government of Kenya
LCH	Life Cycle Hypothesis
RWH	Random Walk Hypothesis

ABSTRACT

This study seeks to investigate the effect of pensions on national savings in Kenya. The study covers the Kenya Government's public pension schemes for its employees. The Granger causality test was employed to investigate the relationship between these two variables and it was found that there was no causal relationship between the two variables. The long run relationship between the two variables was derived using the Vector Error Correction Model. Analyzing the effect of pensions on savings requires the control of other variables which impact on savings. As a byproduct of this paper I investigated the determinants of savings. The specific variables that were of focus in this paper were inflation rate, real interest rate, GDP, dependency ratio (young and old), life expectancy, and labor force participation rate. The methodology adopted involves the lifecycle model. Annual secondary data of the relevant variables for the period 1971-2011 was used in the analysis. Some variables were not stationary and were made stationary after first differencing. Information was sourced from World Bank publications and the Kenya Government's Consolidated Fund Services. The Vector Error Correction Model was employed to investigate these relationships.

The results indicated that pensions expenditure had a negative impact on savings. It was also found that Gross Domestic Product has a positive impact on Gross Domestic Savings. The results also show a negative influence of inflation on Gross Domestic Savings in Kenya. The real interest rate and life expectancy have negative and statistically significant impact on Gross Domestic Savings, suggesting that income effects outweigh the sum of its substitution and human wealth effects. The old age dependency ratio has a negative but statistically insignificant impact on saving while the young age dependency ratio has a positive but statistically significant impact on savings.

CHAPTER ONE
INTRODUCTION

1.1 Background to the Study

A pension promise is a long-term compensation arrangement whereby a worker earns a right to an eventual pension benefit, payable after the employee attains certain eligibility criteria, with benefits frequently commencing at retirement and continuing until death (Gustman, Mitchell and Steinmeier, 1994). In other words a pension provides lifetime income security in retirement for however long the retiree lives (Bodie, 1990). The government of a country plays a significant role in the provision of old age income. The involvement of the government in the provision of pensions can be justified in many different ways, including reasons of efficiency, insurance failure, redistribution, and paternalism.

The efficiency rationale for public pensions arises because of market failures. More specifically, a public pension system can, if appropriately designed, enable trades between generations that would not otherwise take place in a competitive market. In some situations, this can enhance consumption possibilities and welfare for all individuals in society.

The insurance rationale for public pensions arises because individuals face a number of risks over their lifecycle that typically cannot be insured in the private market. The most important of these is the longevity risk (the risk that they will outlive their assets). Individuals who have saved for retirement may live longer than expected and so run out of assets and a public pension system can provide insurance against this eventuality.

The redistribution rationale for public pensions arises from the fact that pension schemes can be used to redistribute resources between individuals of different generations (intergenerational redistribution) or between individuals belonging to the same generation (intra-generational redistribution). To the extent that redistribution between, for example, young and old or rich and poor is socially desirable and cannot be achieved by more efficient policy instruments, a redistribution rationale for public pensions exists.

The paternalistic rationale for public pensions is based on the notion that individuals are not acting to maximize their own welfare because they are myopic in the sense that they make decisions in youth without fully taking into account the implications that these decisions have for their own welfare when old. If this is the case, public interventions that force individuals to save for their own retirement, whether through forced saving or through taxes, can be justified.

For the purpose of pension reform, the taxonomy of mandatory pension systems given by Lindbeck and Persson (2003) is commonly used. Lindbeck and Persson (2003) use a three-dimensional classification: defined contribution vs. defined benefit, funded vs. unfunded, and actuarial vs. non-actuarial pension systems. In a defined contribution, the contribution rate is exogenous while benefits are endogenous; in a defined benefit system, the benefit is either a fixed lump-sum or an amount determined by the individual's previous earnings, implying that future contribution rates have to be endogenous for the pension budget to balance. An unfunded (pay-as-you-go) system is financed by tax on currently working generations, while in a fully funded system benefits are financed by the return on previously accumulated pension funds. The third dimension refers to the relation between contributions and benefits at the individual level ("actuarial fairness"). Actuarial fairness requires that the present value of lifetime contributions equals the present value of lifetime benefits, although the actual outcome could depend on systematic differences in life expectancy, usually in favour of women (Queisser, 2006). The three-dimensional classification facilitates separating the consequences of a pension system for work incentives (actuarial/non-actuarial dimension), capital formation (funded/unfunded dimension) and risk sharing (defined benefit/defined contribution dimension).

1.2 History of Pension Schemes

Pension schemes in the western world began in Germany under the leadership of Chancellor Otto von Bismarck where old-age pensions were created in 1889. Since then, pension schemes have mushroomed all over the globe. Great Britain's Old Age Pensions Act was enacted in 1908 (Hemming and Kay, 1982; Pugh, 2002). Sweden enacted compulsory old age pensions in 1915 (Stahl, 1982) and Switzerland in 1925 (Janssen and Muller, 1982). In the United States, the Social Security Act was enacted in 1935. By 1940, thirty-three countries had some kind of old-age pension plan. By 1958 the number of countries was 80, 123 by 1979, and 130 by 1989.

Poverty caused by old age, sickness, unemployment or death of the breadwinner was as a result of industrialization, vagaries of the economic system which might at any time leave the

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employee without a job, and inadequate wages which meant that workers could not manage to have savings of their own. Support against extreme deprivation in the developing countries was confined to the traditional support systems and missionary activities. The traditional system was based on communal responsibility, where the economically active supported the young, handicapped and sick (Midgley, 1984).

However urbanization, high mobility and European influence has caused people to be individualistic and thus weakening of traditional kinship relations. Missionaries came to spread the gospel, and also introduced schools and hospitals. They looked after the sick, elderly, orphans, the blind and people with other types of handicaps. The colonial authorities also ensured sufficient local labour by imposing taxes payable in cash, which made it necessary for Africans to engage in paid labour in an effort to raise money for taxes (Ojow, 1968; Berman and Lonsdale, 1980). The withering away of the institutional base for security and support following the emergence of urbanization and industrialization made it clear that security in old age, in case of need, had to be increasingly provided by society through its own solidarity (Msalangi, 1998).

Pension schemes in developing countries of Africa were introduced by the imperial governments between the two World Wars although many schemes were introduced after the Second World War. The first schemes were civil service pension schemes and employer's liability schemes such as workmen's compensation. Civil service pension schemes were mainly designed to provide for expatriate colonial administrators (Midgley, 1984) who expected to retire in metropolitan countries. The level of benefits was sufficient to maintain them in relative comfort in these countries. Workmen's compensation provides for employment injury, sickness, death, maternity benefits, child benefits, medical services and employment severance allowance (Msalangi, 1998).

The enormous growth in pension schemes has stimulated much interest in the impact of these retirement programs on individual saving behavior and the level of national savings. The first issue is the extent to which employees covered by social security plans reduce their own direct saving in response to expected retirement benefits, as the response of individuals to guaranteed retirement income will determine, to a large extent, their wellbeing in retirement. For a nation concerned about savings and capital formation, the second issue is the impact of collectivized retirement saving plans on the national saving rate. Kenya's savings rate has been declining over the years as a shown in Figure 1.1.

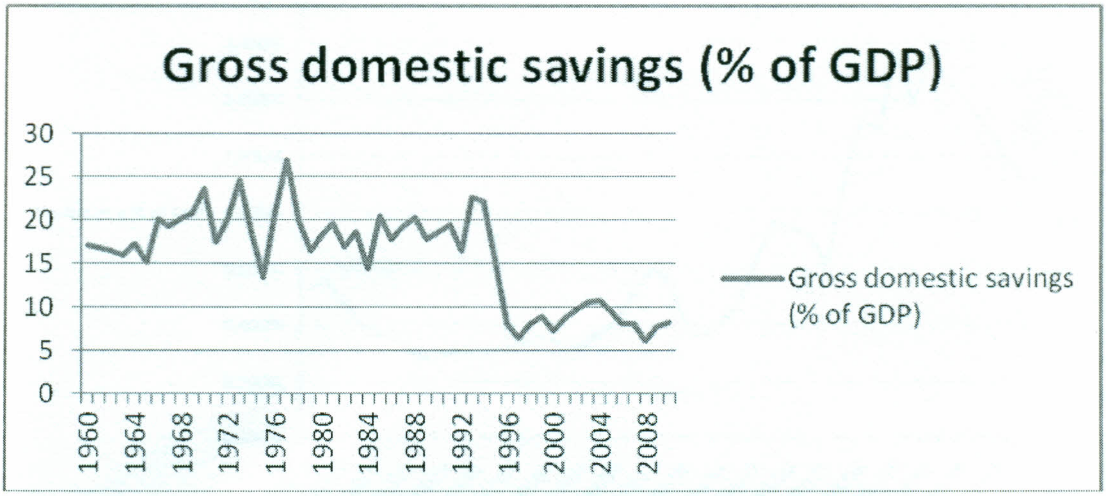

Figure 1.1 Kenya's domestic savings rate as % of GDP for the period 1960-2010

Source: *World Bank*

The Government's civil service pensions expenditure has been increasing over the years (see Figure 1.2). This buildup is expected to accelerate in the next 10 years as those born at the time of Kenya's independence in the early 1960s attain retirement age. This expenditure is expected to peak at about KSh 150 billion by 2034 even if closed to new entrants (Mugo, 2009). This paper seeks to investigate whether this rise in pension spending has contributed to the decline in the saving rate shown above.

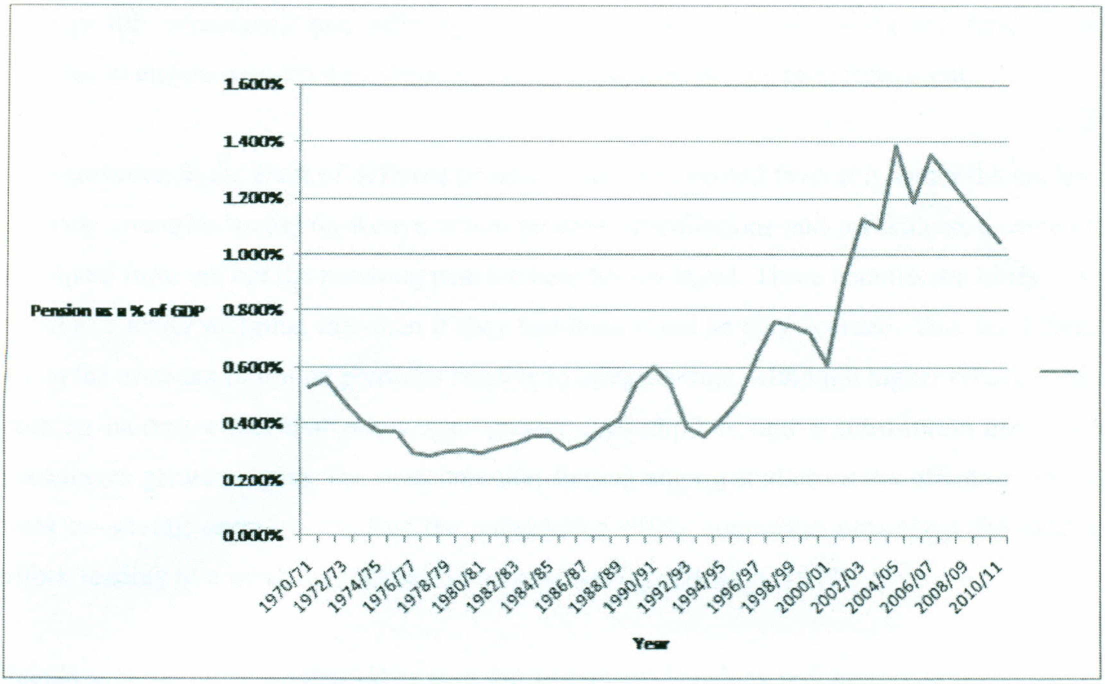

Figure 1.2: Pensions as % of GDP for the period 1970- 2011

Source: Government of Kenya: Consolidated Fund Services

1.3 Effect of Pensions on Savings

First, pensions tends to induce early retirement which would be expected to increase saving, since people who retire early are forced to save at a higher rate over a shorter working life in order to finance a longer period in retirement (Feldstein, 1974; Sala-i-Martin, 1996).

Secondly, given that PAYG programs shift income from children who are taxpayers to parents who are beneficiaries, parents may increase their savings to maintain a target level of bequest for their children thereby offsetting the taxes that their children pay.

Thirdly, pensions are typically illiquid, tax-deferred annuities. Imperfect capital markets often prevent people from borrowing freely against their future benefits, thereby forcing them to save more than they otherwise would have on their own. Illiquidity implies that pensions raise the overall saving for households that face binding borrowing constraints (Hubbard, 1986). As annuities, pensions provide insurance against an uncertain life span, which should reduce overall saving (Hubbard, 1987). Most people would be forced to accumulate sufficient assets to finance an extended retirement. By pooling risks, gearing retirement saving to the average life expectancy and offering annuities, pension systems reduce the total saving required to ensure workers a continuous stream of benefits during their retirement.

Compensation in the form of deferred pension benefits is treated favorably under the tax laws of many countries including Kenya where pension contributions and investment income are exempted from tax but the resulting pension benefits are taxed. These benefits are likely to be taxed at a lower marginal rate than if they had been taxed as they accrued. This tax deferral raises the after-tax return on pensions relative to other savings. Although higher returns create both an income effect that encourages greater consumption, and a substitution effect that encourages greater saving, the most common finding among studies on the effect of interest rates on saving seems to be that the substitution effect somewhat outweighs the income effect, leading to a small net increase in national savings (Boskin, 1978).

People save for other reasons other than for retirement. Pensions will be a poor substitute for precautionary saving (Samwick, 1994), for intended bequests (Bernheim, 1991) or for savings for other nonretirement purposes. To the extent that households save for these reasons, increases in pensions will not be fully offset by reductions in savings. Finally, alternative approaches to saving, in which households create mental accounts for different assets (Thaler, 1990) or lack basic levels of economic literacy (Bernheim, 1994), suggest that pensions may not reduce and may even raise savings.

Pension reforms worldwide share a common aim in that the majority of them strive to move towards a system that would rely more heavily on funded pensions. An important motivation underlying this policy objective is the notion that the accumulation of pension assets contributes to stimulation of savings. A few studies based on the experiences of Chile, Malaysia and Singapore have examined this question but have failed to produce conclusive evidence (Corsetti and Schmidt-Hebbel, 1996; Morandé, 1996; Faruqee and Husain, 1994). Therefore the method used to fund pension schemes impacts on savings. Given the above analysis pensions can have various effects on savings. This study seeks to investigate effect of pensions on national savings in Kenya.

Analyzing the effect of pensions on savings requires the control of other variables which impact on savings. Theoretical and empirical work on saving have consistently outlined the major variables impacting saving which can be broadly grouped as: government policy variables, financial variables, uncertainty variables and external variables. Although the main national saving determinant that we are focused on is pensions, a byproduct of the paper is that we also consider other saving determinants. Thus, we present evidence related to questions repeatedly tackled in the saving literature such as: Do higher interest rates lead to higher national saving? Does national saving vary with a country's income level? Do demographic factors influence national saving?

1.4 Structure of Kenya's Public Pension Schemes

The Government of Kenya has established several types of public schemes which offer social security to its employees e.g. the National Social Security Fund, the National Hospital Insurance Fund, the Civil Servants Pension Fund, the Local Authorities Pension Trust, the Public Universities Superannuation Pension Fund, the Workmen's Compensation Fund, the Widows and Orphans Compensation Fund, and the Parliamentary Pensions Fund. These public schemes are established by Acts of Parliament.

The Civil Service Pension Scheme is governed by the Pensions Act (Cap. 189) and has been subject to numerous amendments since its enactment in 1942. The Scheme covers permanent and pensionable employees of the Government of Kenya, including teachers employed by the Teachers Service Commission, employees of the Judicial Service Commission and members of the disciplined forces (police, administration police, prisons service and the national youth service). Pension benefits are an essential part of the incentives to recruit, retain, motivate and reward civil servants. However, Legal Notice No. 28 of 2005, made under The Service Commissions Act (Cap. 185), states that a public officer who is dismissed "shall forfeit all rights or claims to a pension, gratuity, annual allowance or other retiring award, and any rights or claims he enjoys in regard to leave or passages at the public expense".

The scheme operates on a defined benefits basis and is non-contributory other than modest contributions at 2 percent of member's basic salary per month by male employees towards widows' and orphans benefits (although a married female pensionable officer may also choose to join the scheme if she can prove that her husband is solely dependent on her). The scheme operates on an unfunded pay-as-you-go basis and thus no assets or funds are set aside. Pension benefits are paid out of the Consolidated Fund Services from Government's ordinary revenue.

The last basic salary is the one taken as the basis for calculating the pension entitlement, provided an officer had not been promoted within three years prior to retirement. If the officer was promoted within the three years before retirement, the salary figure for purposes of pension calculation is arrived at by averaging. In both situations, the annual last or averaged salary is divided by 480 and multiplied by the total number of completed or continuous months in pensionable service. This is equivalent to 2.5 percent of final basic salary for each year of service, and targets a pension fraction of 75 percent of basic salary after thirty years of service (2.5 per cent multiplied by 30 years). According to Raichura (2008), a higher pension fraction applies for armed forces and military personnel. Since calculation of the pension is only based on continuous service, interruption or break in service is not taken into account, which includes cases of leave without pay, sick leave without pay, and study leave without pay.

Retiring staff may opt to take up to 25 percent of their pension in the form of lump sum with a commutation factor of 20:1. For example, an officer with ten years' pensionable service and final salary of KSh 600,000 per annum would be eligible for KSh 150,000 per annum (10 years x 12 months x 600,000/480). The fraction 1/480 refers to rate pension benefits accrue per month while one is a member of a defined benefits scheme, and translates to 1/40 per year (or 2.5 per cent). An officer, who elects to receive three-quarters of his annual pension and to receive a lump sum gratuity in lieu of the other one-quarter, would receive a reduced pension of KSh 112,500 (¾ x 150,000) and a commuted pension gratuity of KSh 750,000 (¼ x 150,000 x 20).

Benefits vest after ten years of service and there is no portability of benefits. Pensions' increases are governed by the Pensions (Increase) Act (cap 190), but there was no automatic indexation to changes in the cost of living. However, in 2005, the minimum pension was increased from KSh 500 to KSh 2,000 per month; all pensioners earning KSh 1,000 or less had their pensions reviewed to KSh 2,000 per month; while all other pensions were increased by 3 percent with the initial minimum increase set at KSh 1,000. An automatic pension increase capped at a maximum of 3 percent every two years was granted. The Government also announced an increase in the tax exempt limit for monthly pension from KSh 15,000 to KSh 25,000 (Budget speech for year 2009/10). In addition to increasing the tax-free amount for pensioners, the Government has removed tax on pensions paid to senior citizens (over 65 years of age), and placed those whose pension is taxable under the generous withholding tax

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system instead of the steeper Pay-As-You-Earn (PAYE) tax bands (Budget speech for year 2010/11).

A commutation factor is a number used to convert a pension annuity into a lump sum, and usually depends on the sex of the member and the age at which the conversion takes place. However, the increase in normal retirement age from 55 to 60 years with effect from April 1 2009 was not accompanied by a decrease in the commutation factor, as is supposed to be the case (since life expectancy at retirement decreases with increase in retirement age).

The other public schemes are operated on a defined contribution basis and are funded e.g. NSSF, Local Authorities Pension Trust, Public Universities Superannuation Pension Fund, Workmen's Compensation Fund, Widows and Orphans Compensation Fund, and Parliamentary Pensions Fund.

1.5 Statement of the Research Problem

The effect of pensions on national savings depends on the sum of its effect on households, businesses, and government (Munnell and Yohn, 1991). It also depends on the degree of substitutability and the method used to fund the pension system. The effect of pensions on national savings should not be assessed without previously controlling for other factors which are correlated with national savings.

The effect of pensions on national savings may vary considerably. Empirical studies on the effect of pensions on national savings have yielded a wide variety of results; some indicating a positive relation (Pablo and Alberto, 2004; Ricardo and Alberto, 2006) while others have produced a negative relationship (Luca and Giovanni, 1995; Feldstein, 1996; Edwards, 1996). Given this scenario, the emerging question is its effect on national savings in Kenya.

Although the main determinant of national savings we are focused on is pensions, a byproduct of the paper is that we also consider other saving determinants derived from the lifecycle model. Thus we investigate the effect of various saving determinants on national savings.

1.6 Research Questions

The study seeks to answer the following questions:

a) What is the effect of pensions on national savings in Kenya?

b) What is the effect of other determinants of national savings in Kenya?

c) What are the policy implications of the study findings?

1.7 Objectives of the Study

The study aims to achieve the following objectives:

a) The effect of pensions on national savings in Kenya.

b) The effect of other determinants on national savings in Kenya.

1.8 Significance of the Study

The study on the effect of public pension scheme on national savings in Kenya will have important policy implications. In particular it will help determine whether the method used to fund pension schemes impacts on savings and therefore aid in the restructuring of the country's pension system. It will also add to the existing literature on pensions in Kenya. This study on the variables affecting national savings is a crucial prerequisite in designing a number of policy interventions to encourage savings. It will also help individuals to appreciate the importance of some factors in their saving decisions.

1.9 Scope of the Study

The study will focus on the effect of public pension scheme on national savings in Kenya. It will also focus on the effect of some of the control variables on the savings function that have an effect on national savings in Kenya. The study will cover the period 1971-2011, based on annual time series data sourced from World Bank publications and the Consolidated Fund Services.

1.10 Organization of the Study

Chapter two presents two theoretical models on savings, with focus on the overlapping generations model and random walk hypothesis. It also presents the empirical literature on the effect of pensions on national savings and on other determinants national savings. Chapter three covers the model specification used to study each of the objectives of the study.

Chapter four covers data analysis, which used Granger causality test to investigate the relationship between pensions and savings and the Vector Error Correction Model to study the determinants of savings. The analysis reports on signs of the coefficients, statistical significance of each variable and their implications in influencing the levels of gross domestic savings. The final chapter gives a summary of the main findings and conclusions of the study. It also covers the limitation of the study and areas of further research.

CHAPTER TWO
LITERATURE REVIEW

2.1 Introduction

This chapter is divided into four main sections. The first section deals with theoretical literature on savings. The second section deals with the overlapping generations model of pension systems. The third section reviews empirical literature on the effect of pensions on national savings and on the effect of other factors on national savings. The last section provides the overview of literature.

2.2 Theoretical Literature on Savings

This section considers two theories of savings, though they are not mutually exclusive.

2.2.1 Life Cycle Hypothesis

The most commonly used theory in studying the effect of pension programs on savings is the Lifecycle Hypothesis. Assumptions under this hypothesis include a fixed retirement age, a perfect capital market, no uncertainty, no interest rates, no inflation and no institutional constraints on pensions (tax treatment, restrictions on receiving a benefit while employed at the firm, etc). The assumption under this hypothesis is that an individual who lives for a lifetime period (T) has a lifetime utility function of the following form:

$$U = \sum_{t=1}^{T} u(C_t), \quad u'(.) > 0, \qquad u'' < 0, \quad \ldots\ldots 2.1$$

Where $u(.)$ is the instantaneous utility function and C_t is consumption in period t.

The individual has initial wealth of A_o and labor incomes of $Y_1, Y_2 \ldots\ldots Y_T$ in the T periods of his or her life; the individual takes these as given. The individual can save or borrow at an exogenous interest rate, subject only to the constraint that any outstanding debt be repaid at the end of his or her life. The interest rate is assumed to be zero. Thus the individual's budget constraint is:

$\sum_{t=1}^{T} C_t \leq A_0 + \sum_{t=1}^{T} Y_t$...2.2

Since the marginal utility of consumption is always positive, the individual satisfies the budget constraint with equality. The Lagrangian for his or her maximization problem is therefore:

$L = \sum_{t=1}^{T} u(C_t) + \theta(A_o + \sum_{t=1}^{T} Y_t - \sum_{t=1}^{T} C_t)$...2.3

The first order condition for C_t is

$u'(C_t) = \theta$..2.4

Since 2.4 holds in every period, the marginal utility of consumption is constant. And since the level of consumption uniquely determines its utility, this means that consumption must be constant. Thus $C_1 = C_2 = \cdots = C_T$. Substituting this fact into the budget constraint yields:

$C_t = \frac{1}{T}(A_0 + \sum_{t=1}^{T} Y_t)$..2.5

For all t.

The term in parenthesis is the individual's total lifetime resources. Thus 2.5 state that the individual divides his or her lifetime resources equally among each period of life. The saving relationship can be derived using 2.5 as follows:

$s_t = Y_t - C_t$..2.6

Substituting Right Hand Side of 2.5 in 2.6 yields:

$s_t = \left(Y_{t-\frac{1}{T}} \sum_{t=1}^{T} Y_t\right) - \frac{1}{T} A_o$...2.7

Thus saving is high when income is high relative to its average. Similarly when current income is less than permanent income, saving is negative. Thus the individual uses saving and borrowing to smooth the path of consumption. This is the key idea of the permanent income hypothesis of Modigliani and Brumberg (1954) and Friedman (1957). The lifecycle hypothesis can be modified to allow for bequests and anticipation of bequests to affect savings and work decisions.

Saving varies over an individual's lifetime: a person dissaves before he is capable of working, accumulates savings during working years, and again dissaves after retirement. At the aggregate level an economy with a high working population means that savers outnumber dissavers so that saving is generated in the country. However, the lifecycle theory has come under criticism in recent years primarily because of the alleged importance of intergenerational transfers as a saving motive and the apparent lack of asset decumulation on the part of the elderly (Kotlikoff, 1988; Modigliani, 1998).

2.2.2 Random Walk Hypothesis

The second theory on savings features the precautionary motives which is the Random Walk Hypothesis. Suppose that there is uncertainty about the individual's labor income in each period. We continue to assume that both interest rate and the discount rate is zero. Suppose that the instantaneous utility function is quadratic. The individual maximizes:

$$E[U] = E\left[\sum_{t=1}^{T}\left(C_t - \frac{a}{2}C_t^2\right)\right] \qquad 2.8$$

Where a > 0

Assume that the individual's wealth is such that consumption is always positive. As before the individual must pay off any debt at the end of life; thus the budget constraint is given by equation 2.2 i.e. $\sum_{t=1}^{T} C_t \leq A_0 + \sum_{t=1}^{T} Y_t$.

The individual chooses first period consumption optimally given the information available, and supposes that he or she will choose consumption in each future period optimally given the information then available. To describe the individual saving behavior we use the Euler equation approach. The marginal utility of consumption in period 1 is $1 - aC_1$, the change has a utility cost of $(1 - aC_1)\delta C$. The marginal utility of consumption in period t is $1 - aC_t$, the change has an expected utility benefit of $E_1[1 - aC_t]\delta C$, where $E_1[.]$. denotes

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expectations conditional on the information available in period 1. Thus the individual is optimizing:

$1 - aC_1 = E_1[1 - aC_t]$, ...2.9

for t=2,3,…,T

Since $E_1[1 - aC_t]$ equals $1 - aE_1(C_t)$, this implies:

$C_1 = E_1[C_t]$..2.10

The individual knows that his or her lifetime consumption will satisfy the budget constraint 2.2 with equality. Thus the expectations of the two sides of the constraint must equal:

$\sum_{t=1}^{T} E_1[C_t] = A_0 + \sum_{t=1}^{T} E_1[Y_t]$..2.11

Substituting 2.11 into 2.10 and dividing by T yields:

$C_1 = \frac{1}{T}(A_0 + \sum_{t=1}^{T} E_1[Y_t])$...2.12

This implies that the individual consumes $\frac{1}{T}$ of his or her expected lifetime resources. Equation 2.10 implies that the expectation as of period 1 of C_2 equals C_1. Hence the analysis above implies that for each period, expected next period consumption equals current consumption. This implies that the changes in consumption and hence savings are unpredictable. By the definition of expectations, this yields:

$C_t = E_{t-1}[C_t] + e_t$...2.13

Where e_t is a variable whose expectation as of period t-1 is 0. Thus, since $E_{t-1}[C_t] = C_{t-1}$, we have:

$C_t = C_{t-1} + e_t$..2.14

Thus consumption function follows a random walk. The savings function is given by:

$S_t = Y_t - (C_{t-1} + e_t)$...2.15

The presence of precautionary motives for savings will modify displacement effects by affecting the degree of substitutability between social security and savings.

2.3 Theoretical Economic Models for Pension Systems

Public pensions affect the behavior of individuals and the economy in many different ways, and it is therefore essential to develop a formal framework to keep track of all these effects. A natural starting point for thinking about the impact and social desirability of public pension systems is the so-called overlapping generations (OLG) model. This model has two important features: it takes into account the impact that public pensions have on individuals' lifecycle choices (such as private savings for retirement) and it is explicit about the fact that individuals at different stages of their lifecycle live side-by-side at any given point in time. The model is also a useful tool in analyzing the impact that different public pension systems, in particular funded versus PAYG systems, have on individual retirement savings, capital accumulation and welfare, and in bringing out the main efficiency rationale for public provision of pensions.

2.3.1 The Overlapping Generations Model

The model presented here emanates from Samuelson (1958) and Diamond (1965). The analysis starts with household behavior and then turn to firm behavior.

2.3.1.1 Household Behaviour

The section on household behavior starts by presenting the assumptions governing household behavior in the model. We assume that time is discrete and not continuous. We assume that each individual lives for two periods. Hence, in each time period, there are people who are living the first period of their lives and people who are living the second and final period of their lives. This is the reason for labeling the model the overlapping generations model.

We assume that there are L_t individuals born in each time period and that the population grows at the rate *n*. Hence, $L_{t+1} = (1+n)L_t$. The size of the populations in each time period becomes:

$$L_t + L_{t-1} = L_t + \frac{1}{(1+n)}L_t.$$

We assume that each individual supplies one unit of labour in the first time period of her life. In return for working, the individual receives the wage rate w_t. In the second period of an individual's life, he/she is retired and does not work.

Individuals are born without assets. In the first period, they divide their wage income between consumption and saving. Their savings become the stock of assets they bring forward to the second period. In the second period, they consume all of their assets plus the interest rate earned on the assets from the first to the second period. Individuals consume all of their assets in the second period because they do not want to die with an unused stock of assets.

The notation for consumption is as follows: $C_{1t}$is consumption at time *t* for individuals born at time *t* (who are in the first period of their lives), C_{2t} is consumption at time *t* for individuals born at time *t-1* (who are in the second period of their lives), and C_{2t+1} is consumption at time *t+1* for individuals born at time *t* (who are then in the second period of their lives).

The lifetime utility of an individual born a time *t* is:

$$U_t = \frac{C_{1t}^{1-\theta}-1}{1-\theta} + \frac{1}{(1+\rho)}\frac{C_{2t+1}^{1-\theta}-1}{1-\theta} \quad \text{......2.16}$$

Here, we assume $\theta > 0$ and $\rho > 0$. The factor $\frac{1}{(1+\rho)}$ is a discount factor measuring the subjective valuation of second period consumption relative to first period consumption with ρ as the rate of time preference.

In the first period the individuals divide wage income between consumption and saving:

$$C_{1t} + S_t = W_t \quad \text{......2.17}$$

Hence $C_{1t} = W_t - S_t$......2.18

In the second period, individuals consume their savings plus interest:

$$C_{2t+1} = (1 + r_{t+1})S_t \text{ ....} 2.19$$

where $1 + r_{t+1}$ is the interest rate from period *t* to period *t+1*.

In order to prevent individuals from borrowing without repaying their loans, we assume that $S_t > 0$. This is the equivalent of having a credit market constraint preventing people from having debts when they die.

Inserting 2.18 and 2.19 in 2.16 we obtain:

$$U_t = \frac{(W_t - S_t)^{1-\theta} - 1}{1-\theta} + \frac{1}{(1+\rho)} \frac{\left((1+r_{t+1})S_t\right)^{1-\theta} - 1}{1-\theta} \text{ ....} 2.20$$

Differentiating 2.20 with respect to S_t yields:

$$\frac{dU_t}{dS_t} = (W_t - S_t)^{-\theta}(-1) + \frac{1}{(1+\rho)}\left((1 + r_{t+1})S_t\right)^{-\theta}(1 + r_{t+1}) = 0 \text{ ....} 2.21$$

If we reinsert the expressions for first and second period consumption into 2.21 and solve for the ratio of second period consumption to first period consumption, we get:

$$\frac{C_{2t+1}}{C_{1t}} = \left(\frac{1+r_{t+1}}{1+\rho}\right)^{\frac{1}{\theta}} \text{ ....} 2.22$$

This is the Euler equation governing the optimal path of consumption across time. If we insert 2.18 and 2.19 into 2.22 we find that:

$$S_t = \frac{1}{1+(1+\rho)^{\frac{1}{\theta}}(1+r_{t+1})^{(\theta-1)/\theta}} W_t = \frac{1}{\beta_{t+1}} W_t \text{ ....} 2.23$$

Where $\beta_{t+1} > 1$ since $\rho > 0$ and $r_{t+1} = 0$

The impact on savings of a change in the wage rate and a change in the interest rate becomes:

$$\frac{dS_t}{dW_t} = \frac{1}{\beta_{t+1}} \qquad 2.24$$

and

$$\frac{dS_t}{dr_{t+1}} = \frac{1-\theta}{\theta}\left(\frac{1+\rho}{1+r_{t+1}}\right)^{\frac{1}{\theta}} \frac{W_t}{\beta_{t+1}{}^2} \qquad 2.25$$

Equation 2.24 shows that an increase in the wage rate leads to a proportional rise in savings with $\frac{1}{\beta_{t+1}}$ being the share of wages that the individual saves. Equation 2.25 shows that an increase in the interest rate has an ambiguous effect on savings. If $\theta < 1$, the substitution effect – that an increase in the interest rate makes savings more rewarding –dominates the income effect and therefore an increase in the interest rate raises the level of savings. If $\theta > 1$, the income effect dominates meaning that it is not necessary to save as much in order to reach a specific consumption level in the second period and hence an increase in the interest rate lowers the level of savings.

2.3.1.2 Firm Behaviour

For the firm side of the economy, we only need to make a few assumptions. First, we assume that there is no technological progress. Second, we assume a neoclassical production function of the form:

$$Y = F(K, L) \qquad 2.26$$

Expressed in per capita terms, we can write the production function as $y = f(k)$, where:

$y = \frac{Y}{L}$ and $k = \frac{K}{L}$.

Third we make a standard assumption on capital formation:

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$K_{t+1} - K_t = investment - \delta K_t$..2.27

Where δ is the rate of depreciation of capital. The standard profit optimization conditions are therefore:

$r_t = f'(k_t) - \delta$...2.28

$w_t = f(k_t) - k_t f(k_t)$...2.29

2.3.1.3 Public Pension Systems in the OLG Model

To study a pension system we must add government taxes and transfers to the model. Equation 2.17 becomes $C_{1t} + S_t = W_t - T_t$ where T_t is the tax levied on the young. Equation 2.19 becomes:

$$C_{2t+1} = (1 + r_{t+1})S_t + Z_{t+1}$$

where Z_t is the transfer provided to the old.

The consolidated lifetime budget constraint:

$W_t - T_t + \frac{Z_{t+1}}{1+r_{t+1}} = C_{1t} + \frac{C_{2t+1}}{1+r_{t+1}}$...2.30

The government can introduce a PAYG or a funded pension system. Under a funded pension system, each individual makes a contribution towards the pension in youth via the social security tax. The taxes levied to the young T_t earn market rates on interest r_{t+1}. The pension benefit received by each individual when old is therefore equal to:

$Z_{t+1} = (1 + r_{t+1})T_t$...2.31

In contrast to the funded system, a PAYG system owns no capital. Instead, it relies on the contributions of the young in each generation to provide pensions for the old of the previous generation. The total pension received by the generation born in period t is $L_{t-1}Z_t$ and is financed by a social security tax on generation $t+1$ yielding the revenue $L_t T_t$. For the government, this implies $L_{t-1} Z_t = L_t T_t$, and so each old individual receives:-

$$Z_t = (1 + n)T_t \quad \ldots\ldots 2.32$$

Contribution T_t earns the right to receive $(1 + n)T_{t+1}$ when old, where n is the biological interest rate (Samuelson, 1958; Hausman, 1992).

For an individual making the contribution T_t, a comparison of equations 2.31 and 2.32 shows that whether the PAYG system yields a higher return than the funded system depends on the relative size of the interest rate and the population growth rate. In the funded system, the return is the interest rate earned in the capital market. In the PAYG system, from the point of view of the individual born in period *t*, the "return" to a contribution of 1 unit of money today depends on how many more young people will be around tomorrow to pay into the system when the individual retires. The important point here is that a PAYG system is sensitive to changes in demographics whereas a funded system is not. Equation 2.32 also gives a first indication of the impact of slower population growth: a lower *n* automatically implies either a lower benefit per retired person or a higher tax contribution per worker. In either case, the "return" on a given contribution falls.

The Life Cycle Hypothesis is used to study the impact of a PAYG system on national savings. The Random Walk Hypothesis is an extension of the Life Cycle Hypothesis but involves individual decisions when faced with uncertainty. The OLG model is used to study how the method used to fund pension schemes impacts on national savings. This study will employ the Life Cycle Hypothesis because Kenya's pension system is PAYG, and data on other variables that may impact on saving behavior are available.

2.4 Empirical Studies

2.4.1 Empirical Studies on the Effect of Pensions on Savings

Empirical analyses reveal mixed results on the effect of pensions on national savings. Feldstein (1974) investigated the overall impact of the social security system on aggregate savings and capital formation using U.S. time series data. The author's empirical model was based on the general lifecycle framework. The author specified aggregate consumption as a function of current and lagged disposable income, retained earnings, the rate of unemployment, and household wealth other than from pension and pension wealth. The author measured the pension wealth variable as the present actuarial value of retirement and survivor benefits to which the then current population was entitled. The author estimated the overall impact of pension wealth as a 50 percent reduction in aggregate savings.

Several studies have countered the argument led by Feldstein (1974). Barro (1978) claimed that Feldstein's estimations were biased as a result of the omission of government saving as one of the determinants of the consumption function. Barro showed that pension wealth was not statistically significant when government saving was included in the regression. Another important study was Leimer and Lesnoy (1982) who argued that Feldstein's findings were highly sensitive to the assumptions that he made to construct the pension wealth variable. The authors claimed that the use of reasonable alternative assumptions results in weaker estimates of the relationship between pension and savings. Rochelle (1999) investigated the effects of pension spending on savings rates across countries with varying levels of savings. Contrary to Feldstein (1974), the study suggested that pension spending only depresses saving in countries with high savings rates. Therefore, according to the author, it was important to take into account the different patterns of saving rates in high and low saving countries.

Chang (1995) reviewed the effects of compulsory saving on national saving in Malaysia. The study indicated that the presence of compulsory defined contributions plan reduces national savings. According to the author compulsory saving plans do not induce households to increase their saving but simply lead them to reduce their discretionary saving by an offsetting amount. In addition, the employer contribution redistributes income from the higher saving corporate sector to the low saving household sector leading to a decline in aggregate saving.

Rossi and Visco (1995) investigated the effect of social security on national savings in Italy in the period 1954-1993. Changes in pension laws and regulations which took place in the late sixties and early seventies weakened the link between contributions and benefits permitting a time path of aggregate consumption in excess of what would have occurred in the absence of such changes. They revised and extended these results and found that slightly less than half the reduction in the national saving rate observed was due to the increase of pension wealth.

Feldstein (1996) responded to the above criticisms and tested for the impact of the pension wealth on savings using the U.S. time series data. In addition the data included twenty one additional observations for the years since the original study. The results implied that the pension program induced a reduction in savings by 66 percent of total savings. The author concluded that his estimates are robust to alternative specifications of the consumption expenditure equation. Hence in the U.S. PAYG system, pensions result in reduction in private savings, which may imply that reduction in pensions could induce greater savings and economic growth.

Using a sample of 32 countries (including developed and developing countries) and a panel of more than 200 observations, Edwards (1996) studied the determinants of private savings. Among them was a pension's variable that is defined as the ratio of public expenditure on pensions and welfare to total public expenditures. The pension variable had a negative coefficient.

Jeannine and Reisen (1998) tested the hypothesis that increases in funded pension wealth contribute to higher aggregate savings by employing a panel data set of ten countries (6 industrialized OECD countries and 4 emerging non-OECD countries) over the 1982-1993 period. They developed a proxy for changes in funded pension wealth for this sample of countries based on the pension fund asset data. Using this constructed measure and controlling for other determinants of savings (dependency ratio, growth rate of real per capita GDP, government budget surplus/deficit, real interest rate, domestic credit as a proportion of GDP, real per capita income, and real government pension spending per elderly person) they were able to estimate the relationship between aggregate saving rates and changes in funded pension wealth. Their results suggested that the buildup of pension assets did indeed exert a positive and statistically significant effect on aggregate saving rates, and that this impact differed for OECD and non-OECD countries.

Ehrlich and Zhong (1998) examined the effects of the pension-GDP ratio on fertility, marriage/divorce, saving and growth. They used data for 49 countries over 29 years: 1960-1989. The debate concerning the effects of PAYG defined-benefits pension systems on the real economy focused on savings (Barro, 1978; Feldstein, 1996). The authors expanded this inquiry to include effects on economic growth and underlying family choices. They found that pension had an adverse effect on all these variables.

Evans (2003) investigated whether pension increases consumption and subsequently reduces savings in a group of seventeen countries. The author fitted an Euler equation to annual data spanning the period 1965-1994 for 17 OECD countries. The results provided highly statistically significant evidence that pension raises consumption.

Murphy and Mursalem (2004) conducted an empirical study of the effect of accumulation of pension funds financial assets on national saving using an unbalanced panel of 43 countries. They used the overlapping generations model to study the effect of mandatory pension programs on aggregate saving. They found evidence suggesting that pension saving increases national saving when pension saving is mandatory. Moreover, they found that each additional dollar of mandatory pension saving increased national saving by more than 50 percent of the increase in mandatory pension saving. They also found evidence suggesting that voluntary pension saving (either in the form of pension saving or in the form of insurance saving) did not have a significant effect on national saving.

Bebczuck and Mursalem (2006) assessed the effect of pension saving on the gross national saving rate using a sample of 48 developed and developing countries over the 1980-2004 period. They used a panel estimation for both developed and developing countries on the basis of reduced form national savings equations encompassing a number of explanatory variables (pension saving, old age dependency ratio, young age dependency ratio, urban population, per capita GDP growth, inflation rate, and change in credit to the private sector). The main finding was that a one dollar increase in pension saving increased national saving by between 0 and 20 cents. The structure of the system in terms of mandatory participation and portfolio composition did not affect the results, but the maturity of the system did seem to be a robust driver of national saving, inducing an increase of the saving rate of 0.3-0.5 percentage points for each additional year of existence.

2.4.2 Empirical Studies on Saving Determinants

This section highlighted studies on the different factors that impact on national savings. The determinants considered in this study are those that can directly derived from the Life Cycle

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Hypothesis. Empirical analysis reveals mixed results depending on the variables the author(s) considered important to savings.

Collins (1989) examined saving behaviour in nine Asian developing countries and Turkey since the early 1960s. Regression analysis was used to separate the determinants of savings over time and across countries. The results indicated that population share of children, the standard of living, and the real growth rate all have a significant impact on savings. The results also suggested differences in saving behavior between low-income and middle-income countries. In particular, saving seemed to be less sensitive to the age distribution and to changes in per capita income in poorer countries. The effect for the middle income countries was that a rise in dependency rates reduced saving. Similarly, the net effect of a rise in real per capita income was to raise savings.

Kazmi (1993) attempted to observe impact of different macroeconomic variables on national savings in India and Pakistan using pooled data for the period 1960 to 1988. Ordinary Least Square Method was used to estimate the saving model. The study concluded that growth rate of real GNP, exports, external aid inflows, government expenditures, inflation rate, real interest rate and terms of trade were positively influencing the national saving rate.

Schmidi-Hebbel *et al* (1998) investigated the factors behind the broad and considerable differences in saving across countries of the world and over time. They used time series dataset constructed for the World Bank savings project to assess the policy and non-policy determinants of saving. They reported that lagged private saving rate has a positive and significant coefficient which revealed a large degree of persistence. They reported further that both the (log) level and the growth rate of real per capita private disposable income have a positive and significant effect on private saving rate. The real interest rate had a negative impact on private saving rate. A rise in public saving rate led to a significant decline in the private saving rate. Also, all the three demographic variables under consideration (urbanization ratios, young and old dependency ratio) had a significantly negative impact on private saving rate. They also found that a rise in inflation had a positive impact on saving.

Agarwal (2000) made a detailed empirical analysis of the determinants of savings in South Asia and why South Asia savings rates lag behind the East Asian rates. The causality analysis between saving rate and GNP growth rate was made. The study used pooled time series data of South Asian countries from 1960-1996. Ordinary least square method was employed to estimate these models. The study used variables as percentage of GDP. The results of the study indicated that growth rate of real GDP and money supply were positively affecting national savings while age dependency ratio and foreign savings were negatively affecting national savings.

Loayza *et al* (2000) discussed the design of the research projects on saving in developing countries. The authors stated that the statistically significant variables include terms of trade, foreign borrowing constraints, fiscal policy variables and pension system variables. They also stated that the influence of income is greater in developing than in industrial countries. They also found that GDP growth rate increases the saving rate.

Nasir and Khalid (2004) assessed behavior of saving and investment in Pakistan using data from 1971 to 2003 culled from the Economic Survey of Pakistan. Using ordinary least squares method, the study concluded that government expenditures, growth rate of gross domestic product, and remittances growth positively and significantly influenced national savings.

Bebczuck and Mursalem (2006) analyzed determinants of national savings using a sample of 48 developed and developing countries over the 1980-2004 period. The results indicated that old age dependency ratio and urbanization ratio were negatively correlated with saving, while GDP growth, inflation rate, terms of trade and current account displayed a positive sign.

Adeolu *et al* (2008) investigated the determinants of gross domestic saving in the Economic Community of West African States (ECOWAS). The methodology involved estimation of a saving function derived from the standard lifecycle theory. The saving model was estimated for aggregate ECOWAS using panel data covering 1980-2006. Among the major findings was that growth rate of gross domestic income had a positive but insignificant effect on the gross domestic saving in ECOWAS. However, the gross domestic income per capita had a significant negative impact on the gross domestic saving. Their results also indicated that saving deposit rate had a significant negative impact on the gross domestic saving, while the undesirable impact of the underdevelopment of the financial sector in West Africa was also noticed. Moreover, the results revealed a significant negative impact of inflation, high budget deficit and terms of trade on gross domestic saving.

Using annual panel data for 16 African countries, Apergis and Christou (2012) reveal that dependency ratio causes savings rate negatively, and therefore changes in non-working population size are important in explaining the future path of domestic savings rates in Africa. This suggests that policies that lower the dependency ratio (e.g. fertility reduction) will have a positive impact on savings rates in African countries.

Chaudhry *et al* (2010) investigated the determinants of national savings of Pakistan in the long run as well as in the short run using time series annual data from 1972 to 2008. The results conclude that the consumer price index, exports, workers' remittances, public loans, government spending and rate of interest were very significant factors in determining the national savings in long run. It was also found that consumer price index, workers' remittances, interest rate, exports and government consumption had positive impact on national savings of Pakistan while public loans influenced negatively in the long run.

2.5 Overview of the Literature

This chapter highlighted the two theories on savings and the overlapping generations model for pension systems. It also gave an empirical review of the effect of pensions on national savings. Most of the studies indicated a negative effect of pensions on national savings except for Murphy and Mursalem (2004) and Bebczuck and Mursalem (2006) which indicated a positive effect.

Finally, the chapter gave an empirical review of the effects of determinants of savings on national savings. The savings functions included different factors that the authors thought would affect national savings hence the results are varied. Bebczuck and Mursalem (2006) was the only paper that investigated the effect that both pensions and savings determinants would have on national savings.

This study investigates the effect Kenya's public pension schemes on national savings in Kenya, and the effect of saving determinants on the national savings. In line with the literature particularly for cross-country analysis we consider inflation rate, real interest rate, GDP, dependency ratio (young and old), life expectancy, and labor force participation rate.

CHAPTER THREE

RESEARCH METHODOLOGY

3.1 Theoretical Model

From the review of the literature, the Life Cycle Hypothesis is the most appropriate theory to provide a theoretical basis for this study, as it is capable of explaining the variables that determine saving. The Life Cycle Hypothesis is employed where:

$$s_t = Y_t - \frac{1}{T}(A_0 + \textstyle\sum_{t=1}^{T} Y_t) \quad \ldots\ldots 3.1$$

In the Life Cycle hypothesis, the assumption is that an individual seeks to maximize the present value of lifetime utility subject to the budget constraint. The budget constraint is equal to the current net worth plus the present value of expected income from work over an entire working life of the individual i.e.:

$$A_0 + \textstyle\sum_{t=1}^{T} \frac{1}{(1+r)^t} Y_t$$

After optimization and solving for savings, the savings function as per the lifecycle hypothesis becomes:

$$s_t = \frac{1}{1+r}\left[Y_t - \frac{1}{T}\textstyle\sum_{t+1}^{T} Y_t\right] + \frac{1}{T}A_0 \quad \ldots\ldots 3.2$$

The theory predicts that consumption in each period depends on expectations about lifetime income. Given that income fluctuates over the course of life of an individual, each stage in the lifecycle is an important determinant of saving behaviour. Thus, an individual will smooth consumption over his lifetime, being a net saver in his youth and a net borrower in old age (Modigliani, 1986). From Equation 3.2, the level of income (GDP) is an explanatory variable in the savings function. The role of some demographic characteristics of an economy was stressed in the LCH. The set of variables that make up the demographic factors include old age dependency ratio (ODR), young age dependency ratio (YDR) and life expectancy

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(LE). These variables are sometimes termed lifecycle variables, as they operate under the predictions of the lifecycle hypothesis.

Assuming that the bequest motive for saving is of little importance, the young and old tend to have a low saving rate, while the highest saving rates are recorded by people who are at or around the peak of their earnings. Empirically these can be captured using labor force participation rate (LFPR).

Price movement has been identified as one of the factors that explain saving through its negative impact on income and value of wealth. The consumer price index measures the average rate of prices in the economy. If price levels in the economy increases it has two implications: producers charge high prices of their products to earn more profits which raise national savings. Inflation brings uncertainty in future income and can lead to higher saving on precautionary grounds. There is therefore positive relationship between consumer price index and national saving. On the other hand, consumers have to pay higher prices and this result in low domestic savings, and thus national saving also decreases. From consumers' point of view, there is negative relationship between inflation and national saving. The inflation rate (INF) is used in this paper as a measure of price movements.

3.2 Model Specification

From the discussion above, equation 3.2 can written in the form:

$s = f(GDP, ODR, YDR, RIR, INF, PE, LFPR, LE)$..3.3

Where:

GDP =	Gross Domestic Product
ODR =	Old Age Dependency Ratio
YDR =	Young Age Dependency Ratio
RIR =	Real Interest Rates
INF =	Inflation
PE =	Pension Expenditure
LFPR =	Labor Force participation Rate
LE =	Life Expectancy

The linear model was specified as:

$$S = B_0 + B_1GDP + B_2ODR + B_3YDR + B_4RIR + B_5INF + B_6PE + B_7LFPR + B_8LE + \varepsilon \quad \ldots\ldots 3.4$$

Where B_i are parameters to be estimated and ε is the error term.

3.3 Data and Sources

Quantitative research methods were used to estimate the casual relationship between the dependent and independent variables using time series data. Annual secondary time series data for the period 1971-2011 was used in the analysis. The model required data on gross domestic product, old age dependency ratio, young age dependency ratio, real interest rates, inflation, labor force participation rate and life expectancy. Information was sourced from World Bank publications and the Consolidated Fund Services.

3.4 Definition and Measurement of Variables

Gross Domestic Savings (GDS): Gross Domestic Product less final consumption calculated on annual basis.

Gross Domestic Product (GDP): The monetary value of all finished goods and services produced in a country in a specific time period, usually calculated on an annual basis. It includes all private and public consumption, government outlays, investments and exports less imports.

Pension Expenditure (PE): The government's annual spending for pensions on behalf of its employees.

Old Age Dependency Ratio (ODR): The ratio of the population aged 65 and above to the working age population aged 15-64 years-age.

Young Age Dependency Ratio (YDR): The ratio of the population less than 15 years to the working age population aged 15-64 years-age.

Real Interest Rates (RIR): The actual annual percentage change in the purchasing power of interest income earned on Government treasury bills. It is captured by the average annual real interest rates of 91-day government treasury bills.

Inflation (INF): The rate at which the general level of prices for goods and services is rising, and, subsequently, purchasing power is falling. It is captured by the annual percentage change in the consumer price index of selected representative commodities.

Labor Force participation Rate (LFPR): A measure of the active portion of an economy's labor force. The participation rate refers to the number of people who are either employed or are actively looking for work.

Life Expectancy (LE): The average number of years to be lived by a group of people born in the same year, if mortality at each age remains constant in the future. Life expectancy at birth is also a measure of overall quality of life in a country and summarizes the mortality at all ages.

3.5 Data Analysis

Time series data usually exhibit a non-stationary process, and the results would be spurious if applied directly. Consequently, a test for the order of stationarity was conducted. Some of the variables were logged to make the analysis easier. The Granger causality test was employed to investigate the relationship between pensions and savings, while vector error correction model was used to investigate the relationship between the determinants of savings and the coefficient of the pensions variable.

CHAPTER FOUR
DATA ANALYSIS, INTERPRETATION AND DISCUSSION OF RESULTS

4.1 Introduction

This chapter presents summary statistics of the variables used and the correlation matrix to test for multicollinearity among the variables. Before estimation, the data was tested for their time series properties using the Augmented Dickey Fuller test. Non-stationary data was made stationary by differencing. The existence of a cointegration relationship among the variables was carried out. The Granger causality test was used to investigate the relationship between pensions and savings. Model estimation was carried out using the Vector Error Correction Model. Various diagnostic tests were conducted on the results of the estimated model. Lastly, analysis were done on the outcome of the estimation as regard to signs of the coefficients, statistical significance of each variable, and their implications in influencing the levels of gross domestic savings.

4.2 Summary Statistics

Table 4.1 shows the summary statistics of the dataset for each variable.

Table 4.1: Summary statistics of the variables

	LN_GDS	LN_GDP	LE	INF	LNPE	ODR	RIR	YDR
Mean	24.96293	27.30517	56	12.87805	20.95837	5.731707	6.536585	94.60976
Median	25.0542	27.42833	56	11	20.85902	6	5	100
Maximum	25.80277	28.01663	60	46	24.10205	7	21	106
Minimum	24.1996	26.25955	52	2	18.04852	5	-7	77
Std. Dev.	0.374986	0.44216	2.683282	8.31924	2.092059	0.806982	7.27701	11.68306
Skewness	-0.20708	-0.41387	0.015721	1.779293	0.108553	0.518129	0.176282	-0.4134
Kurtosis	2.446554	2.370835	1.708333	7.544456	1.593975	1.75728	2.486918	1.460697
Jarque-Bera	0.816307	1.846706	2.851877	56.91417	3.457738	4.472727	0.662071	5.215614
Probability	0.664877	0.397185	0.240283	0	0.177485	0.106846	0.71818	0.073696
Sum	1023.48	1119.512	2296	528	859.293	235	268	3879
Sum Sq. Dev.	5.62459	7.820228	288	2768.39	175.0685	26.04878	2118.195	5459.756
Observations	41	41	41	41	41	41	41	41

Source: Own Calculations

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Evidently, the Jarque-Bera statistic rejects the null hypothesis of normal distribution for inflation. On the contrary, the null hypothesis of normal distribution is not rejected for gross domestic savings, gross domestic product, life expectancy, pension expenditure, old age dependency ratio, young age dependency ratio and the real interest rate. This is further demonstrated by the graphical representation in Appendix II. The statistic for skewness shows that life expectancy, inflation, pension expenditure, old age dependency ratio and the real interest rate are positively skewed, implying that these distributions have long right tails. On the other hand, gross domestic savings, gross domestic product and the young age dependency ratio are negatively skewed, meaning that the distributions have long left tails. The statistic for Kurtosis shows that inflation is leptokurtic since its distribution is peaked relative to the normal. On the other hand, gross domestic savings, gross domestic product, life expectancy, pension expenditure, old age dependency ratio, young age dependency ratio and the real interest rate are platykurtic, suggesting that its distribution is flat relative to the normal.

The correlation matrix of the variables is shown in Table 4.2. The correlation matrix was used to test for the existence of multicollinearity between the variables. Variables are highly correlated if the correlation coefficients are approaching one and to be lowly correlated if these coefficients are approaching zero.

Table 4.2: Correlation Matrix

	LN_GDS	LN_GDP	LE	INF	LNPE	ODR	RIR	YDR
LN_GDS	1	0.359299	0.53052	0.408658	0.226969	-0.17004	-0.43206	-0.10652
LN_GDP	0.359299	1	-0.16036	0.03543	0.962509	-0.91891	0.307232	-0.86472
LE	0.53052	-0.16036	1	0.31358	-0.38403	0.242454	-0.32008	0.600499
INF	0.408658	0.03543	0.31358	1	-0.08498	-0.05713	-0.34123	0.133765
LNPE	0.226969	0.962509	-0.38403	-0.08498	1	-0.90065	0.394587	-0.95937
ODR	-0.17004	-0.91891	0.242454	-0.05713	-0.90065	1	-0.43891	0.821242
RIR	-0.43206	0.307232	-0.32008	-0.34123	0.394587	-0.43891	1	-0.38063
YDR	-0.10652	-0.86472	0.600499	0.133765	-0.95937	0.821242	-0.38063	1

Source: Own Calculations

The coefficients of correlation in most of the variables were less than 0.5 depicting low degree of multicollinearity. The variables that were highly correlated with others in general was the young dependency ratio, the old age dependency ratio and GDP. The results show that there is inverse relationship between gross domestic saving and old age dependency ratio, the real interest rates and the young age dependency ratio. The results also indicate positive relationship between gross domestic saving and GDP, life expectancy, inflation and pensions expenditure.

Before estimation, the data series was tested for stationarity using Augmented Dickey Fuller test. Non-stationary series in the data were made stationary by differencing. Unit root test on both the dependent and explanatory variables in the model was conducted. The Augmented Dickey Fuller (ADF) test was employed to identify the order of integration for the variables of interest. The equation to be estimated for the ADF test for variable X is:

$$\Delta X_t = \alpha_0 + \beta_1 X_{t-1} + \delta t + \sum_{t=1}^{m} \theta_i \Delta X_{t-1} + \varepsilon_t$$

Where Δ is the first-difference operator, t is the time trend, ε is the stationary random error, and m is the maximum lag length. The null hypothesis is that the series contains a unit root which implies that β_1=0. The null hypothesis is rejected if β_1 is negative and statistically significant.

Table 4.3 gives the unit root tests results:

Table 4.3: Augmented Dickey-Fuller test for unit root

VARIABLE	TEST STATISTIC	CRITICAL VALUES
LN_GDS	-2.182876	-3.526609
D(LN_GDS)	-6.976948	-3.529758
LN_GDP	-2.541200	-3.529758
D(LN_GDP)	-4.719420	-3.529758
ODR	-1.873360	-3.526609
D(ODR)	-6.435496	-3.529758
LE	-3.856522	-3.544284
RIR	-4.649393	-3.526609
INF	-3.854682	-3.526609
LNPE	-2.795768	-3.529758
D(LNPE)	-4.863999	-3.529758
YDR	-4.486549	-3.540328

Source: Own Calculations

The results in Table 4.3 show that four variables are stationary at level (life expectancy, real interest rates, inflation and the young age dependency ratio) and four variables are non-stationary at level but become stationary after differencing the variables once (gross domestic savings, gross domestic product, old age dependency ratio and pensions expenditure).

4.3 Cointegration Analysis

The next step is to test for the existence of a cointegration relationship among the variables. Engle and Granger (1987) pointed out that a linear combination of two or more non-stationary series may be stationary. If such a stationary linear combination exists, the non-stationary time series are said to be cointegrated. The stationary linear combination is called the cointegrating equation and may be interpreted as a long-run equilibrium relationship among the variables. For this purpose, the study uses the Johansen-Juselius (Johansen and Juselius, 1990) maximum likelihood cointegration test procedure.

To determine the number of cointegrating relations r conditional on the assumptions made about the trend, we can proceed sequentially from r=0 to r=k-1 until we fail to reject. The trace statistic reported in the first block tests the null hypothesis of r cointegrating relations against the alternative of k cointegrating relations, where k is the number of endogenous variables, for r=0,1,…,k-1. The alternative of cointegrating relations corresponds to the case where none of the series has a unit root and a stationary VAR may be specified in terms of the levels of all of the series. The trace statistic for the null hypothesis of r cointegrating relations is computed as:

$$LR_{tr}(t \setminus k) = T \sum_{i=r+1}^{k} \log(1 - \lambda_i)$$

Where λ_i is the i^{th} largest eigenvalue of the matrix which is reported in the second column of the output table. The maximum eigenvalue statistic tests the null hypothesis of r cointegrating relations against the alternative of r+1 cointegrating relations. This test statistic is computed as:

$LR_{max}(r \setminus r+1) = -T\log(1-\lambda_{r+1}) = LR_{tr}(r \setminus k) - LR_{tr}(r+1 \setminus k),$

For r=0,1,…,k-1

Table 4.4: Unrestricted Cointegration Rank Test Results

Null Hypothesis	Trace Statistic	Critical Value At 5 Per Cent	Null Hypothesis	Maximum Eigen Statistic	Critical Value At 5 Per Cent
r=0*	231.3564	159.5297	r=0*	66.29808	52.36261
r≤1*	165.0584	125.6154	r≤1*	52.78222	46.23142
r≤2*	112.2761	95.75366	r≤2*	40.67924	40.07757
r≤3*	71.59689	69.81889	r≤3	33.75848	33.87687
r≤4	37.83841	47.85613	r≤4	18.26394	27.58434
r≤5	19.57447	29.79707	r≤5	13.33164	21.13162
r≤6	6.242822	15.49471	r≤6	4.792800	14.26460
r≤7	1.450022	3.841466	r≤7	1.450022	3.841466

Source: Own Calculations

Both the trace test and the maximum eigenvalue statistics reject the null hypothesis of no cointegration. It is necessary to note that the result of the Johansen-Juselius cointegration test revealed that the trace statistic indicates 4 cointegrating equations while the maximum-eigenvalue statistic indicates 3 cointegrating equations (see Table 4.4). Johansen and Juselius (1990) recommend the use of the trace statistics when there is a conflict between the two statistics. We conducted an exogeneity test to establish the four relationships. The results are given in the appendix. The results show that the four equations can be normalized at gross domestic savings, pension expenditure, life expectancy and the gross domestic product. This indicates that there is a feedback mechanism between the four variables.

4.4 Relationship between Gross Domestic Savings and Pensions Expenditure

Granger causality test was used to examine the causal relationship between pensions expenditure and gross domestic savings. The following equations were estimated:

$$\mathrm{LN\_GDS}_t = a_1 + \sum_{i=1}^{p} b_i\,\mathrm{LNPE}_{t-i} + \sum_{j=1}^{q} r_j \mathrm{LN\_GDS}_{t-j} + e_1$$

and

$$\mathrm{LNPE}_t = a_2 + \sum_{i=1}^{p} c_i \,\mathrm{LN\_GDS}_{t-i} + \sum_{j=1}^{q} d_j \mathrm{LNPE}_{t-j} + e_2$$

Where it is assumed that both e_1 and e_2 are uncorrelated white noise error terms. The results are given in Table 4.5.

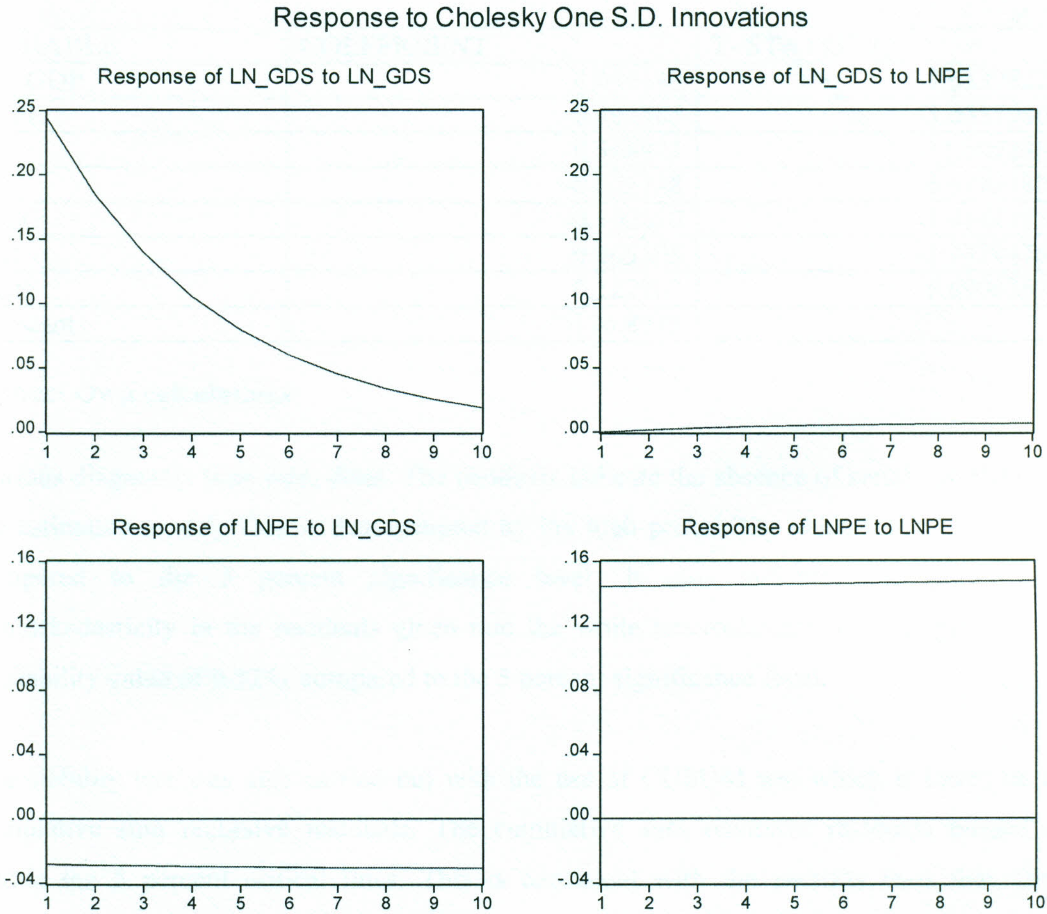
Table 4.5: VAR Granger Causality/Block Exogeneity Wald Test Results

Dependent variable: LN_GDS			
Excluded	Chi-sq	df	Prob.
LNPE	0.383820	1	0.5356
All	0.383820	1	0.5356
Dependent variable: LNPE			
Excluded	Chi-sq	df	Prob.
LN_GDS	0.000758	1	0.9780
All	0.000758	1	0.9780

Source: Own Calculations

The results indicates no causality either way between Gross Domestic Savings and pensions, which is in contrast to the findings in a number of studies that have found pensions to have a negative impact on gross domestic savings. The lack of causality between pensions and savings is further confirmed by the impulse response that shows no permanent effect of a shock through savings. As the second graph below (response of LN_GDS to LNPE) indicates a shock on gross domestic savings in the short-run leads to a slight increase in pensions but which levels off in 6 years. The third graph (response of LNPE to LN_GDS) confirms that there is no causality in the lags from pensions to savings.

Impulse Response Results



Source: Own Calculations

We therefore derive the coefficient for the long run relationship between the two variables using the vector error correction model as highlighted below.

4.5 Determinants of Savings

Equation 3.4 was estimated to obtain long-run coefficients since the variables are cointegrated. The exogeneity test shows that the four equations can be normalized at gross domestic savings, pension expenditure, life expectancy and gross domestic product. The equation was normalized at gross domestic savings. The results of the estimated equations are presented in Table 4.6.

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Table 4.6: Gross Domestic Savings Function regression results: long run model

VARIABLE	COEFFICIENT	T- STATISTIC
LN_GDP	4.039140	7.633982234
LNPE	-0.402585	-3.033798041
LE	-0.368973	-11.50523854
INF	-0.022738	-6.648538012
ODR	-0.102210	-1.414475505
RIR	-0.008305	-1.737447699
YDR	0.122907	6.690636908
Constant	-116.8875	

Source: Own calculations

Various diagnostic tests were done. The residuals indicate the absence of serial correlation in the estimated model. This is demonstrated by the high probability value 0.6767 at lag one compared to the 5 percent significance level. It also indicates the presence of homoskedasticity in the residuals given that the white heteroskedasticity test gave a high probability value of 0.3241 compared to the 5 percent significance level.

The stability test was also carried out with the use of CUSUM test which is based on the cumulative sum recursive residuals. The cumulative sum recursive residuals plotted are within the 5 percent critical lines. This is consistent with the stability tests that, for a parameter to be stable, the plotted cumulative sum should be within 5 percent critical lines as represented in Appendix III.

Inserting the results on Table 4.6 into the equation 3.4 gives the following long run relationship:

$$S = -116.8875 + 4.039140\,GDP - 0.102210\,ODR + 122907\,YDR - 0.008305\,RIR \\ - 0.022738\,INF - 0.402585\,PE - 0.368973\,LE$$

The pension expenditure variable is found to be negatively correlated with the dependent variable and statistically significant at 5 percent significance level. Thus the change in Government's pension scheme has a negative effect on the change in the gross domestic savings. This supports the lifecycle model where higher retirement benefits reduce saving needs, as the expected coefficient was negative. This outcome is supported by Edwards (1996) who defined the pensions variable as the ratio of public expenditure on pensions and welfare to total public expenditures and found that the pensions variable had a negative coefficient.

The inflation variable is found to be negatively correlated with the dependent variable and statistically significant at 5 percent significance level. According to economic theory, inflation has both positive and negative effects on saving. If inflation increases, producers charge high prices of their products to earn more profits which raises national savings. Inflation also brings uncertainty in future income and can lead to higher saving on precautionary grounds, and hence a positive relationship between inflation and national saving. On the other hand consumers have to pay higher prices and this result in low domestic savings, and thus national saving decreases. From consumers' point of view, there is negative relationship between inflation and national saving. Thus the negative results are consistent with economic theory. Kazmi (1993) found negative relationship between national savings and inflation rate.

The change in the gross domestic product has a significant positive impact on the change in gross domestic saving. This result follows the *a priori* expectation and is consistent with the result of previous studies for developing countries (see Collins, 1989; Schmidt-Hebbel *et al*, 1998). Schmidt-Hebbel *et al* (1998) reported that both the (log) level and the change in real per capita private disposable income have a positive and significant effect on the private saving rate, which is clearly consistent with the Life Cycle model.

Empirical results indicate that old age dependency ratio is negatively correlated with the dependent variable and statistically insignificant at 5 percent significance level. The change in the old age dependency ratio has a negative impact on the change in gross domestic saving, which is consistent with the life cycle model where labor income vanishes when people reach retirement and they start to dissave. Therefore, we expect a negative coefficient for ODR. This outcome is consistent with Schmidi-Hebbel *et al* (1998) who found that old dependency ratio had a significant negative impact on private saving rate.

Empirical results indicate that young age dependency ratio is positively correlated with the dependent variable and statistically significant at 5 percent significance level. The young age dependency ratio has a positive impact on gross domestic saving, although we expect a negative coefficient from economic theory. The results are also inconsistent with the life cycle model. This outcome is consistent with Keho (2011) who investigated the effect of age dependency rates on savings for a group of 16 African countries. They found a positive effect in two countries (Cameroon and Sierra Leone).

Empirical results indicate that the real interest rate variable is negatively correlated with the dependent variable and statistically significant at 5 percent significance level. The young age dependency ratio has a negative impact on gross domestic saving, which suggests that income effect outweighs the sum of substitution and human wealth effects. This result is consistent with the findings of Schmidt-Hebbel *et al* (1998) which reported negative effect of interest rate on saving rate for a sample of 10 developing countries. According to theory an increase in real interest rate will affect individual saving through two different forces that work in opposite directions: it will make present consumption more expensive thus inducing an increase in saving; and it will make possible the transformation of a given amount of present consumption into more units of future consumption thus inducing a fall in saving. In addition, there is no easy answer on the way in which an increase in real interest rate will affect government and/or firms saving (Ogaki, Ostry and Reinhart, 1996).

Empirical results indicate that the life expectancy variable is negatively correlated with the dependent variable and statistically significant at 5 percent significance level. Thus the change in life expectancy leads to a negative change in the gross domestic savings. This is the case where the aged people are inactive and thus do not continue to involve themselves in productive and income earning activities till their death. This is inconsistent with the lifecycle model where life expectancy is expected to have a positive impact on savings.

CHAPTER FIVE
SUMMARY, CONCLUSION AND POLICY RECOMMENDATIONS

5.1 Summary and Conclusion

In this paper we raised the hypothesis that increase in pensions expenditure lead to a decrease in savings. The lifecycle model suggests that pensions have a negative effect on savings. To achieve this objective, the study employed the Granger causality test to investigate the relationship between the pensions expenditure and gross domestic savings. It was found that there was no causal relationship between the two variables. The long run relationship between the two variables was derived using the Vector Error Correction model. Empirical results indicate that pensions have a negative effect on Gross Domestic Savings, as the coefficient was negative and statistically significant. Thus increase in pension expenditure cause a declining rate of savings as indicated in Chapter One of this study. This supports the lifecycle model where higher retirement benefits reduce the need for savings.

As a byproduct of this paper we investigated the determinants of savings. The framework for analysis involved estimation of a saving rate function derived from the Life Cycle Hypothesis. The study employed the Vector Error Correction model which minimizes the possibility of estimating spurious relations, while at the same time retaining long-run information. The results indicate that life expectancy with a t ratio of -11.50523854 was the most significant determinant of gross domestic savings. It was also found that gross domestic product has a positive impact on gross domestic saving. The result also shows a negative influence of inflation on gross domestic saving in Kenya, which is rather surprising because it implies that there is no need to maintain price stability to promote savings in Kenya.

Results show that real interest rate has a negative and statistically significant impact on gross domestic saving, suggesting that income effects outweigh the sum of its substitution and human-wealth effects. The old age dependency ratio has a negative but statistically insignificant impact on saving while the young age dependency ratio has a positive but statistically significant impact on saving.

5.2 Recommendation and Policy Implications

The results indicate that pensions have a negative impact on saving. The government could engage in policies that promote saving. This could be done by making the civil servant pension scheme fully funded as is the case of other public schemes that the government operates.

The empirical results reveal that income variable (GDP) promotes saving. In order to enhance this effect, there is the need for the government to raise the level of income so as to reduce the level of poverty in Kenya. Saving cannot be encouraged in the presence of high level of poverty. Macroeconomic environment for production, particularly adequate power supply and transportation network, needs to be improved while productivity and output can be enhanced through human resource development. Low level of income is also a result of high rate of population growth. Therefore, rapid population growth needs to be checked unless it can be matched with a corresponding rapid output growth.

In relation to both old and young dependency rates, the government could make considered effort to provide employment which will reduce the dependency rate and promote saving.

The paradox of life expectancy not promoting saving as indicated by the empirical results (and the fact that life expectancy is low in Kenya) needs more examination. However, the government should aim to implement policies and programmes designed to increase life expectancy in Kenya so as to stimulate saving.

5.3 Limitations of the Study

In the course of carrying out this study, some constraints were encountered. Data on labor force participation rate was incomplete for Kenya and was therefore left out of the analysis. Furthermore not all potential determinants of Gross Domestic Savings were included in the estimated model. The study relied on quantitative data only, whereas qualitative data which could have improved the results was left out due to the nature of the research.

5.4 Suggested Areas for Further Research

The use of cross-sectional data may be required to compliment the findings of this study. The analysis could be done for the different types of public schemes in Kenya e.g. NSSF, Civil Servants Pension Fund, the Local Authorities Pension Trust, the Public Universities

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Superannuation Pension Fund, the Workmen's Compensation Fund, the Widows and Orphans Compensation Fund, and the Parliamentary Pensions Fund. The impact of pensions on saving in Kenya could be investigated by the use of the Overlapping Generations Model. This study could be extended by including other types of pension schemes available to the private sector such as the occupational pension schemes and personal pension plans.

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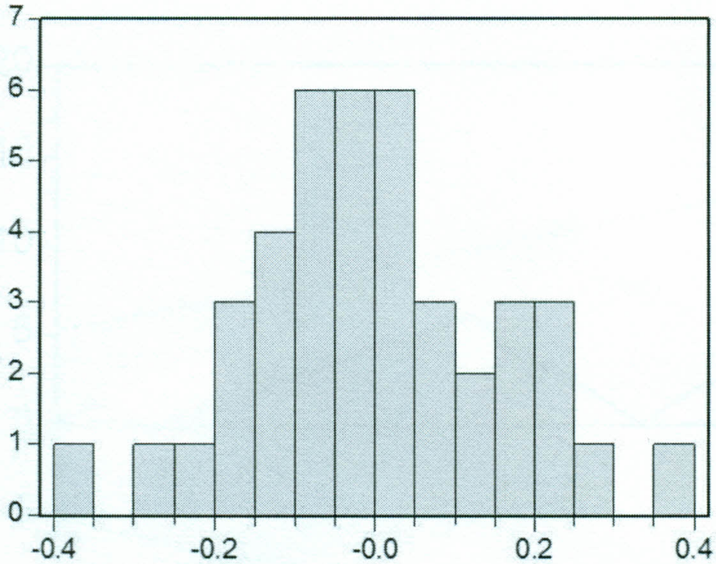
APPENDIX I: BASIC DATA

Year	GDS	PE	GDP	ODR	YDR	RIR	LE	INF
1971	24.26311	18.09368	26.25955	7	104	20	53	4
1972	24.69424	18.04852	26.45982	7	104	8	53	6
1973	25.00823	18.05574	26.61753	7	105	-1	54	9
1974	24.5889	18.13731	26.67482	7	105	-6	54	18
1975	24.46821	18.30796	26.71467	7	105	-2	55	19
1976	24.8593	18.26562	26.72346	7	106	-7	56	11
1977	25.20366	18.48328	26.74477	7	106	-6	56	15
1978	24.822	18.64033	26.8351	7	106	7	57	17
1979	24.82992	18.74997	26.90194	7	106	4	57	8
1980	24.94649	18.86137	26.97533	6	106	1	58	14
1981	25.17952	19.07679	27.02974	6	106	1	58	12
1982	25.0038	19.27441	27.06679	6	106	3	59	21
1983	25.08702	19.46081	27.08174	6	106	4	59	11
1984	24.95467	19.58542	27.09474	6	106	4	59	10
1985	25.22946	19.57321	27.11214	6	106	5	60	13
1986	25.06008	19.77762	27.15425	6	105	5	60	3
1987	25.13896	20.03847	27.22357	6	105	8	60	9
1988	25.14575	20.26689	27.28124	6	104	8	60	12
1989	25.15661	20.65648	27.34143	6	103	7	60	14
1990	25.17264	20.88189	27.38726	6	101	7	59	18
1991	25.2796	20.91186	27.42833	6	100	6	59	20
1992	25.18252	20.7224	27.44261	5	98	2	58	27
1993	25.34261	20.85902	27.43458	5	96	3	58	46
1994	25.25592	21.22174	27.43811	5	94	16	57	29
1995	24.62573	21.53371	27.4641	5	92	16	56	2
1996	24.92388	21.94037	27.50721	5	90	-6	55	9
1997	24.53823	22.28396	27.54785	5	88	17	54	11
1998	24.33917	22.36465	27.55258	5	87	21	54	7
1999	24.1996	22.3989	27.58496	5	85	17	53	6
2000	24.52599	22.49852	27.60775	5	84	15	52	10
2001	24.53556	22.96395	27.61373	5	82	18	52	6
2002	24.44439	23.17879	27.65083	5	81	17	52	2
2003	24.49373	23.24815	27.65628	5	80	10	52	10
2004	25.0542	23.60362	27.68519	5	79	5	52	12
2005	25.19517	23.56812	27.73497	5	78	8	53	10
2006	25.17715	23.82538	27.79236	5	78	5	54	14
2007	25.27906	23.87347	27.85363	5	78	7	54	10
2008	25.55192	23.94846	27.92134	5	77	1	55	26
2009	25.37156	24.00097	27.9365	5	77	5	56	9
2010	25.54882	24.00913	27.96261	5	77	12	56	4
2011	25.80277	24.10205	28.01663	5	77	3	57	14

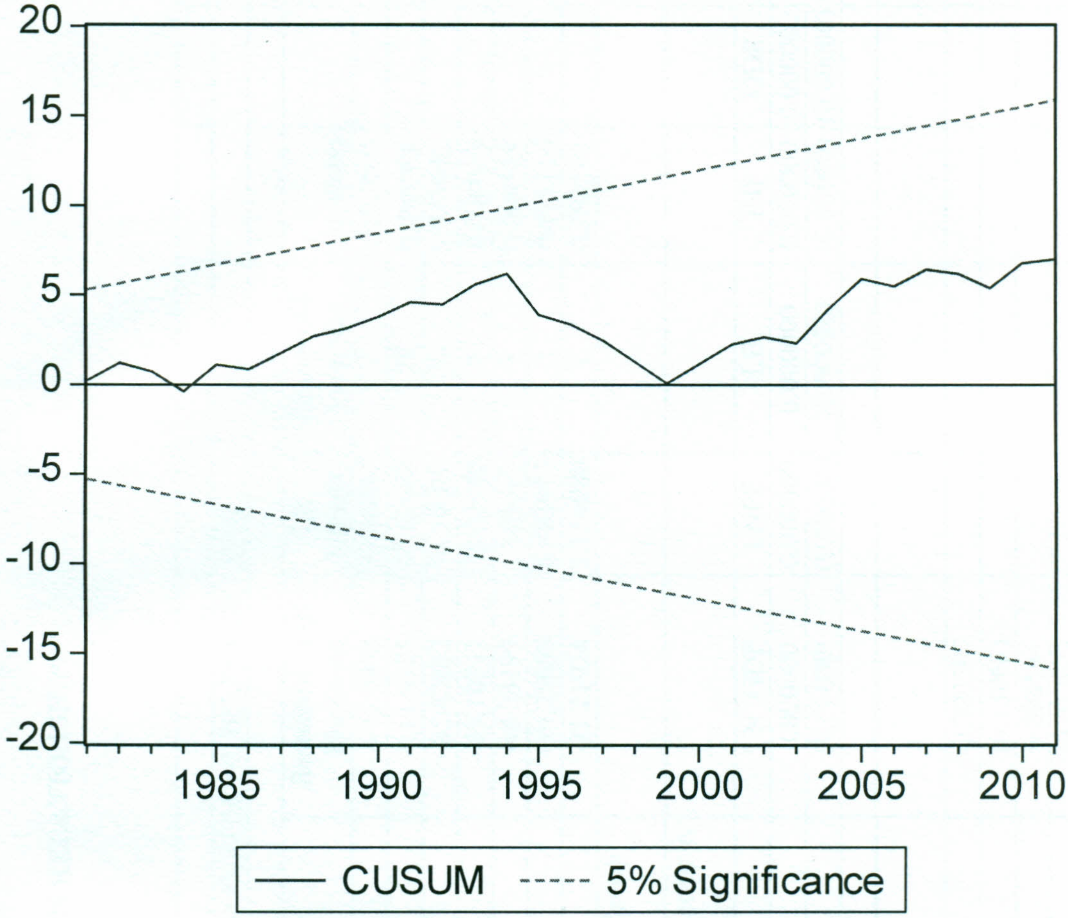
APPENDIX II: NORMALITY TEST



Series: Residuals
Sample 1971 2011
Observations 41

Mean	-1.60e-15
Median	-0.015174
Maximum	0.375651
Minimum	-0.382117
Std. Dev.	0.158591
Skewness	0.106099
Kurtosis	2.957837
Jarque-Bera	0.079959
Probability	0.960809

APPENDIX III: CUSUM TEST



APPENDIX IV: PICKING THE LONG RUN RELATIONSHIPS

Exogeneity test

Restrictions:							
B(1,1)=1, B(1,2)=0, B(1,3)=0, B(1,4)=0, B(1,5)=0, B(1,6)=0, B(1,7)=0, B(1,8)=0							
Tests of cointegration restrictions:							
Hypothesized No. of CE(s)	Restricted Log-likelihood	LR Statistic	Degrees of Freedom	Probability			
1	-143.9908	59.04894	7	0.000000			
2	-111.6325	47.11452	20	0.000566			
3	-85.42852	35.38579	23	0.047602			
4	-65.10711	28.50145	4	0.000010			
5	-48.25197	13.05511	3	0.004519			
6	-39.25058	8.383977	2	0.015116			
7	-33.21924	1.114080	1	0.291197			
1 Cointegrating Equation(s): Convergence achieved after 1 iterations							
Restricted cointegrating coefficients (standard error in parentheses)							
LN_GDS	LN_GDP	LNPE	LE	INF	ODR	RIR	YDR
1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)	(0.00000)
Adjustment coefficients (standard error in parentheses)							
D(LN_GDS)	-0.203507						
	(0.13865)						
D(LN_GDP)	0.006644						
	(0.01304)						

D(LNPE)	-0.003732						
	(0.08524)						
D(LE)	0.050447						
	(0.38316)						
D(INF)	0.847119						
	(4.40633)						
D(ODR)	-0.072641						
	(0.14242)						
D(RIR)	4.345829						
	(3.27135)						
D(YDR)	-0.229745						
	(0.37562)						

Restrictions:							
B(2,1)=0, B(2,2)=1, B(2,3)=0, B(2,4)=0, B(2,5)=0, B(2,6)=0, B(2,7)=0, B(2,8)=0							
Tests of cointegration restrictions:							
Hypothesized No. of CE(s)	Restricted Log-likelihood	LR Statistic	Degrees of Freedom	Probability			
2	-107.3842	38.61800	6	0.000001			
3	-81.09331	26.71537	5	0.000065			
4	-61.95891	22.20504	4	0.000182			
5	-48.04582	12.64280	3	0.005476			
6	-39.88982	9.662440	2	0.007977			
7	-34.30214	3.279891	1	0.070134			
2 Cointegrating Equation(s): Convergence achieved after 24 iterations.							
Restricted cointegrating coefficients (not all coefficients are identified)							
LN_GDS	LN_GDP	LNPE	LE	INF	ODR	RIR	YDR
6.431655	25.47972	-2.656839	-2.314679	-0.146210	-.654451	-.046467	0.756362

0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Adjustment coefficients (standard error in parentheses)							
D(LN_GDS)	-0.107283	0.181766					
	(0.03612)	(0.11957)					
D(LN_GDP)	-0.006009	-0.003427					
	(0.00368)	(0.01219)					
D(LNPE)	0.014729	-0.067778					
	(0.02479)	(0.08207)					
D(LE)	0.095312	0.205002					
	(0.11106)	(0.36769)					
D(INF)	2.735696	5.825027					
	(1.12196)	(3.71459)					
D(ODR)	-0.040629	0.073021					
	(0.04147)	(0.13728)					
D(RIR)	0.638636	-2.287897					
	(0.98524)	(3.26193)					
D(YDR)	-0.061468	-0.315080					
	(0.10957)	(0.36277)					

Restrictions:							
B(3,1)=0, B(3,2)=0, B(3,3)=1, B(3,4)=0, B(3,5)=0, B(3,6)=0, B(3,7)=0, B(3,8)=0							
Tests of cointegration restrictions:							
Hypothesized No. of CE(s)	Restricted Log-likelihood	LR Statistic	Degrees of Freedom	Probability			
3	-79.89177	24.31228	5	0.000189			
4	-60.81227	19.91177	4	0.000520			
5	-47.04438	10.63992	3	0.013841			
6	-39.22119	8.325192	2	0.015567			
7	-33.98455	2.644716	1	0.103895			

3 Cointegrating Equation(s): Convergence achieved after 15 iterations.							
Restricted cointegrating coefficients (not all coefficients are identified)							
LN_GDS	LN_GDP	LNPE	LE	INF	ODR	RIR	YDR
6.327923	25.54274	-2.587255	-2.323977	-0.143682	-.646963	-.050357	0.769307
5.506720	-18.39575	1.131066	0.455906	-0.167093	-.233144	0.070997	-.359634
0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000	0.000000
Adjustment coefficients (standard error in parentheses)							
D(LN_GDS)	-0.103476	-0.008530	0.037565				
	(0.03573)	(0.03571)	(0.02255)				
D(LN_GDP)	-0.006240	0.012481	-0.000220				
	(0.00273)	(0.00272)	(0.00172)				
D(LNPE)	0.012830	0.008854	-0.014721				
	(0.02455)	(0.02453)	(0.01550)				
D(LE)	0.095608	0.257956	0.073558				
	(0.09663)	(0.09657)	(0.06100)				
D(INF)	2.849702	1.155151	1.191802				
	(1.08489)	(1.08423)	(0.68483)				
D(ODR)	-0.040871	0.074882	0.022403				
	(0.03821)	(0.03818)	(0.02412)				
D(RIR)	0.599725	0.682861	-0.488652				
	(0.96972)	(0.96914)	(0.61213)				
D(YDR)	-0.070502	0.256499	-0.031922				
	(0.09803)	(0.09797)	(0.06188)				

Restrictions:							

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B(4,1)=0, B(4,2)=0, B(4,3)=0, B(4,4)=1, B(4,5)=0, B(4,6)=0, B(4,7)=0, B(4,8)=0							
Tests of cointegration restrictions:							
Hypothesized No. of CE(s)	Restricted Log-likelihood	LR Statistic	Degrees of Freedom	Probability			
4	-64.12843	26.54408	4	0.000025			
5	-47.39265	11.33646	3	0.010039			
6	-39.25644	8.395694	2	0.015028			
7	-32.68001	0.035640	1	0.850262			
4 Cointegrating Equation(s): Convergence achieved after 48 iterations.							
Restricted cointegrating coefficients (not all coefficients are identified)							
LN_GDS	LN_GDP	LNPE	LE	INF	ODR	RIR	YDR
6.306020	25.43020	-2.527965	-2.325820	-0.143133	-.645189	-.052194	0.775415
5.467325	-18.17391	1.019165	0.467581	-0.168468	-.228460	0.070693	-.372833
6.139030	5.722512	-2.347182	-0.745820	-0.011646	0.239485	0.334207	0.015397
0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000	0.000000
Adjustment coefficients (standard error in parentheses)							
D(LN_GDS)	-0.100396	-0.012102	-0.067766	-0.009491			
	(0.03454)	(0.03476)	(0.03518)	(0.01419)			
D(LN_GDP)	-0.006305	0.012750	0.001200	0.001023			
	(0.00266)	(0.00268)	(0.00271)	(0.00109)			
D(LNPE)	0.011386	0.010416	0.037355	0.002067			
	(0.02378)	(0.02393)	(0.02421)	(0.00977)			
D(LE)	0.103354	0.241429	-0.118495	-0.052201			
	(0.09190)	(0.09249)	(0.09359)	(0.03774)			
D(INF)	2.934075	1.130470	-2.162732	0.082953			

	(1.06574)	(1.07259)	(1.08535)	(0.43770)			
D(ODR)	-0.038924	0.070250	-0.013974	-0.015288			
	(0.03789)	(0.03813)	(0.03859)	(0.01556)			
D(RIR)	0.551080	0.834161	-1.821296	0.454677			
	(0.90292)	(0.90872)	(0.91954)	(0.37083)			
D(YDR)	-0.071319	0.254761	-0.131232	-0.017223			
	(0.09398)	(0.09458)	(0.09571)	(0.03860)			

Restrictions:							
B(5,1)=0, B(5,2)=0, B(5,3)=0, B(5,4)=0, B(5,5)=1, B(5,6)=0, B(5,7)=0, B(5,8)=0							
Tests of cointegration restrictions:							
Hypothesized No. of CE(s)	Restricted Log-likelihood	LR Statistic	Degrees of Freedom	Probability			
5	-44.53926	5.629691	3	0.131084			
6	-35.94319	1.769188	2	0.412882			
7	-32.66982	0.015259	1	0.901691			
5 Cointegrating Equation(s): Convergence achieved after 14 iterations.							
Restricted cointegrating coefficients (not all coefficients are identified)							
LN_GDS	LN_GDP	LNPE	LE	INF	ODR	RIR	YDR
6.305338	25.46240	-2.542003	-2.326989	-0.143054	-.646553	-.052143	0.774053
5.544408	-18.29614	1.084444	0.446293	-0.166479	-.247852	0.072873	-.363089
5.842997	6.340461	-2.706381	-0.671358	-0.017688	0.239074	0.324671	-.033467
-3.738571	5.967837	-5.039376	0.953920	-0.043317	-.894546	-.171931	-.705871
0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000	0.000000
Adjustment coefficients (standard error in parentheses)							

D(LN_GDS)	-0.109345	- 0.030249	-0.050194	-0.020702	-.011694		
	(0.03185)	(0.03330)	(0.03369)	(0.03330)	(0.00600)		
D(LN_GDP)	-0.006220	0.012540	0.001515	-0.003057	6.52E-05		
	(0.00268)	(0.00280)	(0.00283)	(0.00280)	(0.00050)		
D(LNPE)	0.008587	0.002079	0.049059	0.053725	-.004121		
	(0.02159)	(0.02257)	(0.02284)	(0.02257)	(0.00407)		
D(LE)	0.107524	0.274350	-0.166371	-0.065505	0.008905		
	(0.09451)	(0.09883)	(0.09999)	(0.09881)	(0.01781)		
D(INF)	2.680933	0.484647	-1.514453	-1.787800	-.347173		
	(0.88860)	(0.92917)	(0.94013)	(0.92901)	(0.16747)		
D(ODR)	-0.043009	0.067028	-0.012580	0.051570	-.004842		
	(0.03757)	(0.03928)	(0.03975)	(0.03928)	(0.00708)		
D(RIR)	0.768661	1.156269	-2.010337	1.842107	0.268565		
	(0.77836)	(0.81390)	(0.82350)	(0.81375)	(0.14669)		
D(YDR)	-0.073636	0.252756	-0.122343	0.172908	-.002561		
	(0.09011)	(0.09423)	(0.09534)	(0.09421)	(0.01698)		

Restrictions:							
B(6,1)=0, B(6,2)=0, B(6,3)=0, B(6,4)=0, B(6,5)=0, B(6,6)=1, B(6,7)=0, B(6,8)=0							
Tests of cointegration restrictions:							
Hypothesized No. of CE(s)	Restricted Log-likelihood	LR Statistic	Degrees of Freedom	Probability			
6	-37.54603	4.974872	2	0.083123			
7	-34.22426	3.124135	1	0.077141			
6 Cointegrating Equation(s): Convergence achieved after 13 iterations							
Restricted cointegrating coefficients (not all coefficients are identified)							
LN_GDS	LN_GDP	LNPE	LE	INF	ODR	RIR	YDR

6.302445	25.46521	-2.543682	-2.323729	-0.143205	-0.638260	-0.052167	0.773206
5.516052	-18.41563	1.134230	0.451942	-0.167499	-0.257767	0.071532	-.357432
5.841827	6.066930	-2.591582	-0.708777	-0.017069	0.090703	0.322675	-.011109
-3.733303	5.610363	-4.894370	0.906084	-0.042311	-2.090315	-0.174373	-.677734
2.267426	-5.216062	1.129134	-0.363946	0.102171	-1.787603	0.001930	0.102140
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000
Adjustment coefficients (standard error in parentheses)							
D(LN_GDS)	-0.102520	-0.005323	-0.060770	-0.030722	-0.070018	-0.086865	
	(0.03188)	(0.03206)	(0.03381)	(0.03334)	(0.03862)	(0.07922)	
D(LN_GDP)	-0.006214	0.012382	0.001172	-0.003441	-0.001679	0.001851	
	(0.00260)	(0.00262)	(0.00276)	(0.00272)	(0.00315)	(0.00646)	
D(LNPE)	0.010116	0.012899	0.052247	0.056414	-0.022428	-0.076661	
	(0.02091)	(0.02103)	(0.02218)	(0.02187)	(0.02533)	(0.05196)	
D(LE)	0.103549	0.248652	-0.169899	-0.067537	0.109607	0.154478	
	(0.09287)	(0.09338)	(0.09849)	(0.09712)	(0.11250)	(0.23076)	
D(INF)	2.885232	1.256533	-1.827135	-2.093516	-2.609201	-2.727426	
	(0.84624)	(0.85088)	(0.89743)	(0.88489)	(1.02507)	(2.10259)	
D(ODR)	-0.042820	0.082402	0.005065	0.068557	0.009785	-0.159416	
	(0.03352)	(0.03371)	(0.03555)	(0.03506)	(0.04061)	(0.08329)	
D(RIR)	0.624669	0.566682	-1.877590	1.960495	1.251189	2.513470	
	(0.79100)	(0.79533)	(0.83884)	(0.82712)	(0.95816)	(1.96534)	
D(YDR)	-0.068627	0.248296	-0.153560	0.144925	0.002774	0.174557	
	(0.08800)	(0.08848)	(0.09332)	(0.09202)	(0.10659)	(0.21864)	

Restrictions:							
B(6,1)=0, B(6,2)=0, B(6,3)=0, B(6,4)=0, B(6,5)=0, B(6,6)=1, B(6,7)=0, B(6,8)=0							
Tests of cointegration restrictions:							
Hypothesized No. of CE(s)	Restricted Log-	LR	Degrees of	Probability			

	likelihood	Statistic	Freedom				
6	-37.54603	4.974872	2	0.083123			
7	-34.22426	3.124135	1	0.077141			
6 Cointegrating Equation(s): Convergence achieved after 13 iterations.							
Restricted cointegrating coefficients (not all coefficients are identified)							
LN_GDS	LN_GDP	LNPE	LE	INF	ODR	RIR	YDR
6.302445	25.46521	-2.543682	-2.323729	-0.143205	-0.638260	-0.052167	0.773206
5.516052	-18.41563	1.134230	0.451942	-0.167499	-0.257767	0.071532	-.357432
5.841827	6.066930	-2.591582	-0.708777	-0.017069	0.090703	0.322675	-.011109
-3.733303	5.610363	-4.894370	0.906084	-0.042311	-2.090315	-0.174373	-.677734
2.267426	-5.216062	1.129134	-0.363946	0.102171	-1.787603	0.001930	0.102140
0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000	0.000000
Adjustment coefficients (standard error in parentheses)							
D(LN_GDS)	-0.102520	-0.005323	-0.060770	-0.030722	-0.070018	-0.086865	
	(0.03188)	(0.03206)	(0.03381)	(0.03334)	(0.03862)	(0.07922)	
D(LN_GDP)	-0.006214	0.012382	0.001172	-0.003441	-0.001679	0.001851	
	(0.00260)	(0.00262)	(0.00276)	(0.00272)	(0.00315)	(0.00646)	
D(LNPE)	0.010116	0.012899	0.052247	0.056414	-0.022428	-0.076661	
	(0.02091)	(0.02103)	(0.02218)	(0.02187)	(0.02533)	(0.05196)	
D(LE)	0.103549	0.248652	-0.169899	-0.067537	0.109607	0.154478	
	(0.09287)	(0.09338)	(0.09849)	(0.09712)	(0.11250)	(0.23076)	
D(INF)	2.885232	1.256533	-1.827135	-2.093516	-2.609201	-2.727426	
	(0.84624)	(0.85088)	(0.89743)	(0.88489)	(1.02507)	(2.10259)	
D(ODR)	-0.042820	0.082402	0.005065	0.068557	0.009785	-0.159416	
	(0.03352)	(0.03371)	(0.03555)	(0.03506)	(0.04061)	(0.08329)	
D(RIR)	0.624669	0.566682	-1.877590	1.960495	1.251189	2.513470	
	(0.79100)	(0.79533)	(0.83884)	(0.82712)	(0.95816)	(1.96534)	
D(YDR)	-0.068627	0.248296	-0.153560	0.144925	0.002774	0.174557	

	(0.08800)	(0.08848)	(0.09332)	(0.09202)	(0.10659)	(0.21864)	

Restrictions:							
B(7,1)=0, B(7,2)=0, B(7,3)=0, B(7,4)=0, B(7,5)=0, B(7,6)=0, B(7,7)=1, B(7,8)=0							
Tests of cointegration restrictions:							
Hypothesized No. of CE(s)	Restricted Log-likelihood	LR Statistic	Degrees of Freedom	Probability			
7	-32.88090	0.437410	1	0.508375			
7 Cointegrating Equation(s): Convergence achieved after 9 iterations							
Restricted cointegrating coefficients (not all coefficients are identified)							
LN_GDS	LN_GDP	LNPE	LE	INF	ODR	RIR	YDR
6.297037	25.43363	-2.525110	-2.327672	-0.143164	-0.645342	-0.052593	0.776394
5.520308	-18.36409	1.118210	0.452290	-0.167197	-0.236583	0.071860	-0.359726
5.890733	6.452476	-2.768037	-0.682104	-0.016335	0.209888	0.326573	-0.039713
-3.705830	5.944367	-5.003869	0.910702	-0.040617	-1.958885	-0.172116	-0.693605
1.965405	-8.207988	2.395164	-0.525230	0.096559	-2.734424	-0.025346	0.299464
0.835620	0.932377	0.645721	-0.200790	0.102112	2.880530	-0.016185	0.021400
0.000000	0.000000	0.000000	0.000000	0.000000	0.000000	1.000000	0.000000
Adjustment coefficients (standard error in parentheses)							
D(LN_GDS)	-0.076088	0.008735	-0.098237	0.005037	-0.044152	0.032671	0.020629
	(0.03686)	(0.03429)	(0.03680)	(0.04851)	(0.03112)	(0.05983)	(0.01645)
D(LN_GDP)	-0.006984	0.011948	0.002264	-0.004515	-0.002900	-0.000681	-0.000603
	(0.00303)	(0.00281)	(0.00302)	(0.00398)	(0.00255)	(0.00491)	(0.00135)
D(LNPE)	0.013965	0.011080	0.038742	0.051014	0.000309	-0.022438	0.002056
	(0.02491)	(0.02318)	(0.02487)	(0.03279)	(0.02103)	(0.04044)	(0.01112)
D(LE)	0.181978	0.315802	-0.226000	0.109158	0.041771	0.315951	0.067714
	(0.10482)	(0.09752)	(0.10465)	(0.13796)	(0.08849)	(0.17013)	(0.04679)

D(INF)	2.956538	1.139790	-2.265798	-2.427877	-1.631953	-1.281705	0.015859
	(0.99821)	(0.92872)	(0.99659)	(1.31383)	(0.84269)	(1.62020)	(0.44563)
D(ODR)	-0.036213	0.077212	-0.023624	0.052769	0.072739	-0.062390	0.002929
	(0.03756)	(0.03494)	(0.03750)	(0.04943)	(0.03171)	(0.06096)	(0.01677)
D(RIR)	-0.026955	0.245472	-0.891238	1.154271	0.382216	-0.533734	-0.501411
	(0.91318)	(0.84961)	(0.91170)	(1.20192)	(0.77091)	(1.48220)	(0.40767)
D(YDR)	-0.011883	0.300644	-0.186610	0.283224	-0.063610	0.235193	0.049842
	(0.10061)	(0.09360)	(0.10044)	(0.13241)	(0.08493)	(0.16329)	(0.04491)

Vector Error Correction Estimates								
Sample (adjusted): 1973 2011								
Included observations: 39 after adjustments								
Standard errors in ( ) & t-statistics in [ ]								
Cointegrating Eq:	CointEq1	CointEq2	CointEq3	CointEq4				
LN_GDS(-1)	1.000000	0.000000	0.000000	0.000000				
LN_GDP(-1)	0.000000	1.000000	0.000000	0.000000				
LNPE(-1)	0.000000	0.000000	1.000000	0.000000				
LE(-1)	0.000000	0.000000	0.000000	1.000000				
INF(-1)	0.224876	0.144724	0.358437	1.864290				
	(0.04754)	(0.02789)	(0.06771)	(0.36277)				
	[4.73015]	[5.18976]	[5.29378]	[5.13905]				
ODR(-1)	1.890838	1.119452	2.980980	14.40371				
	(0.88779)	(0.52076)	(1.26441)	(6.77442)				
	[2.12983]	[2.14967]	[2.35760]	[2.12619]				
RIR(-1)	0.500906	0.279786	0.680442	3.700461				
	(0.06765)	(0.03968)	(0.09634)	(0.51619)				
	[7.40469]	[7.05103]	[7.06258]	[7.16877]				

YDR(-1)	0.002448	0.022669	0.125040	-0.214747				
	(0.04814)	(0.02824)	(0.06856)	(0.36734)				
	[0.05086]	[0.80279]	[1.82377]	[-0.58461]				
C	-42.09059	-39.51433	-58.81450	-165.6742				
Error Correction:	D(LN_GDS)	D(LN_GDP)	D(LNPE)	D(LE)	D(INF)	D(ODR)	D(RIR)	D(YDR)
CointEq1	-0.965641	0.049984	0.194028	1.362448	20.59929	-0.125627	-9.839283	-0.402636
	(0.36718)	(0.02871)	(0.23696)	(1.03025)	(10.2135)	(0.40835)	(8.92352)	(0.97242)
	[-2.62986]	[1.74108]	[0.81882]	[1.32244]	[2.01688]	[-0.30764]	[-1.10262]	[-0.41406]
CointEq2	-3.120003	-0.397126	0.667763	-3.344111	24.79457	-2.231990	6.379522	-6.332523
	(1.09965)	(0.08598)	(0.70966)	(3.08543)	(30.5875)	(1.22295)	(26.7244)	(2.91222)
	[-2.83727]	[-4.61894]	[0.94096]	[-1.08384]	[0.81061]	[-1.82509]	[0.23872]	[-2.17446]
CointEq3	0.659523	0.041234	-0.368324	0.652429	12.46667	0.005015	-8.286165	-0.045209
	(0.21588)	(0.01688)	(0.13932)	(0.60572)	(6.00482)	(0.24008)	(5.24642)	(0.57172)
	[3.05506]	[2.44292]	[-2.64378]	[1.07711]	[2.07611]	[0.02089]	[-1.57939]	[-0.07908]
CointEq4	0.242035	0.016287	-0.007537	-0.058670	-7.059211	0.182975	2.140826	0.528697
	(0.08897)	(0.00696)	(0.05742)	(0.24964)	(2.47482)	(0.09895)	(2.16226)	(0.23563)
	[2.72035]	[2.34131]	[-0.13126]	[-0.23502]	[-2.85241]	[1.84920]	[0.99009]	[2.24379]
D(LN_GDS(-1))	0.044633	-0.009401	-0.023286	-0.239603	-15.80700	0.037448	11.76360	-0.075690
	(0.24243)	(0.01895)	(0.15645)	(0.68022)	(6.74341)	(0.26961)	(5.89174)	(0.64204)
	[0.18410]	[-0.49596]	[-0.14884]	[-0.35224]	[-2.34407]	[0.13889]	[1.99663]	[-0.11789]
D(LN_GDP(-1))	0.627763	0.060401	-1.316168	-2.659802	13.41888	-1.423780	-19.29662	3.349500
	(1.68048)	(0.13139)	(1.08450)	(4.71514)	(46.7437)	(1.86890)	(40.8401)	(4.45045)
	[0.37356]	[0.45971]	[-1.21362]	[-0.56410]	[0.28707]	[-0.76183]	[-0.47249]	[0.75262]

D(LNPE(-1))	-0.487785	0.031670	0.270133	-0.974854	-25.99923	0.318379	12.47178	-0.178939
	(0.29338)	(0.02294)	(0.18933)	(0.82318)	(8.16059)	(0.32628)	(7.12993)	(0.77697)
	[-1.66263]	[1.38066]	[1.42676]	[-1.18426]	[-3.18595]	[0.97579]	[1.74921]	[-0.23030]
D(LE(-1))	-0.156713	-0.012251	0.016693	-0.138545	-4.844098	-0.060014	-1.006589	0.129738
	(0.08876)	(0.00694)	(0.05728)	(0.24904)	(2.46882)	(0.09871)	(2.15702)	(0.23506)
	[-1.76565]	[-1.76543]	[0.29143]	[-0.55633]	[-1.96211]	[-0.60799]	[-0.46666]	[0.55195]
D(INF(-1))	-0.008750	0.000721	0.003026	0.034176	-0.126717	0.010468	0.389286	0.019252
	(0.00642)	(0.00050)	(0.00414)	(0.01801)	(0.17852)	(0.00714)	(0.15598)	(0.01700)
	[-1.36337]	[1.43627]	[0.73050]	[1.89782]	[-0.70981]	[1.46652]	[2.49582]	[1.13268]
D(ODR(-1))	-0.375508	-0.022510	0.093796	-0.108911	-8.297777	-0.131687	4.339878	0.146724
	(0.19827)	(0.01550)	(0.12795)	(0.55631)	(5.51503)	(0.22050)	(4.81850)	(0.52508)
	[-1.89392]	[-1.45208]	[0.73304]	[-0.19577]	[-1.50457]	[-0.59722]	[0.90067]	[0.27943]
D(RIR(-1))	-0.003824	-0.000916	-0.005230	0.037833	-0.194496	0.007710	0.364836	0.039774
	(0.00875)	(0.00068)	(0.00565)	(0.02456)	(0.24349)	(0.00974)	(0.21274)	(0.02318)
	[-0.43683]	[-1.33794]	[-0.92577]	[1.54035]	[-0.79878]	[0.79199]	[1.71495]	[1.71569]
D(YDR(-1))	0.144170	-0.002046	-0.061267	0.098409	2.559908	-0.074617	-1.664246	0.096219
	(0.08078)	(0.00632)	(0.05213)	(0.22665)	(2.24690)	(0.08984)	(1.96312)	(0.21393)
	[1.78476]	[-0.32398]	[-1.17526]	[0.43419]	[1.13931]	[-0.83059]	[-0.84775]	[0.44978]
C	0.165349	0.030971	0.132526	0.455438	5.763220	-0.090847	-2.342408	-0.736621
	(0.10244)	(0.00801)	(0.06611)	(0.28742)	(2.84931)	(0.11392)	(2.48945)	(0.27128)
	[1.61418]	[3.86693]	[2.00473]	[1.58459]	[2.02267]	[-0.79745]	[-0.94093]	[-2.71534]
R-squared	0.502617	0.796913	0.368135	0.535937	0.699622	0.247299	0.636138	0.732779
Adj. R-squared	0.273056	0.703180	0.076505	0.321754	0.560986	-0.100102	0.468202	0.609446

Sum sq. resids	1.154736	0.007059	0.480920	9.090871	893.4330	1.428203	682.0075	8.098853
S.E. equation	0.210744	0.016477	0.136003	0.591311	5.861980	0.234373	5.121626	0.558117
F-statistic	2.189469	8.501987	1.262335	2.502242	5.046459	0.711854	3.787976	5.941478
Log likelihood	13.29536	112.6930	30.37591	-26.94093	-116.4030	9.150722	-111.1374	-24.68774
Akaike AIC	-0.015147	-5.112462	-0.891072	2.048253	6.636053	0.197399	6.366023	1.932704
Schwarz SC	0.539374	-4.557941	-0.336552	2.602773	7.190574	0.751919	6.920543	2.487225
Mean dependent	0.028424	0.039918	0.155219	0.102564	0.205128	-0.051282	-0.128205	-0.692308
S.D. dependent	0.247175	0.030244	0.141525	0.717997	8.847181	0.223456	7.023193	0.893068
Determinant resid covariance (dof adj.)	4.80E-08							
Determinant resid covariance	1.87E-09							
Log likelihood	-50.85639							
Akaike information criterion	9.582379							
Schwarz criterion	15.38352							

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APPENDIX V: VECTOR ERROR CORRECTION ESTIMATES

Sample (adjusted): 1973 2011				
Included observations: 39 after adjustments				
Standard errors in ( ) & t-statistics in [ ]				
Cointegrating Eq:	Coint Eq1	Coint Eq2	Coint Eq3	Coint Eq4
LN_GDS(-1)	1.000000	0.000000	0.000000	0.000000
LN_GDP(-1)	0.000000	1.000000	0.000000	0.000000
LNPE(-1)	0.000000	0.000000	1.000000	0.000000
LE(-1)	0.000000	0.000000	0.000000	1.000000
INF(-1)	0.224876	0.144724	0.358437	1.864290
	(0.04754)	(0.02789)	(0.06771)	(0.36277)
	[4.73015]	[5.18976]	[5.29378]	[5.13905]
ODR(-1)	1.890838	1.119452	2.980980	14.40371
	(0.88779)	(0.52076)	(1.26441)	(6.77442)
	[2.12983]	[2.14967]	[2.35760]	[2.12619]
RIR(-1)	0.500906	0.279786	0.680442	3.700461
	(0.06765)	(0.03968)	(0.09634)	(0.51619)
	[7.40469]	[7.05103]	[7.06258]	[7.16877]
YDR(-1)	0.002448	0.022669	0.125040	-0.214747
	(0.04814)	(0.02824)	(0.06856)	(0.36734)
	[0.05086]	[0.80279]	[1.82377]	[-0.58461]
C	-42.09059	-39.51433	-58.81450	-165.6742

Error Correction:	D(LN_GDS)	D(LN_GDP)	D(LNPE)	D(LE)	D(INF)	D(ODR)	D(RIR)	D(YDR)
CointEq1	-0.965641	0.049984	0.194028	1.362448	20.59929	-0.125627	-9.839283	-0.402636
	(0.36718)	(0.02871)	(0.23696)	(1.03025)	(10.2135)	(0.40835)	(8.92352)	(0.97242)
	[-2.62986]	[1.74108]	[0.81882]	[1.32244]	[2.01688]	[-0.30764]	[-1.10262]	[-0.41406]
CointEq2	-3.120003	-0.397126	0.667763	-3.344111	24.79457	-2.231990	6.379522	-6.332523
	(1.09965)	(0.08598)	(0.70966)	(3.08543)	(30.5875)	(1.22295)	(26.7244)	(2.91222)
	[-2.83727]	[-4.61894]	[0.94096]	[-1.08384]	[0.81061]	[-1.82509]	[0.23872]	[-2.17446]
CointEq3	0.659523	0.041234	-0.368324	0.652429	12.46667	0.005015	-8.286165	-0.045209
	(0.21588)	(0.01688)	(0.13932)	(0.60572)	(6.00482)	(0.24008)	(5.24642)	(0.57172)
	[3.05506]	[2.44292]	[-2.64378]	[1.07711]	[2.07611]	[0.02089]	[-1.57939]	[-0.07908]
CointEq4	0.242035	0.016287	-0.007537	-0.058670	-7.059211	0.182975	2.140826	0.528697
	(0.08897)	(0.00696)	(0.05742)	(0.24964)	(2.47482)	(0.09895)	(2.16226)	(0.23563)
	[2.72035]	[2.34131]	[-0.13126]	[-0.23502]	[-2.85241]	[1.84920]	[0.99009]	[2.24379]
D(LN_GDS(-1))	0.044633	-0.009401	-0.023286	-0.239603	-15.80700	0.037448	11.76360	-0.075690
	(0.24243)	(0.01895)	(0.15645)	(0.68022)	(6.74341)	(0.26961)	(5.89174)	(0.64204)
	[0.18410]	[-0.49596]	[-0.14884]	[-0.35224]	[-2.34407]	[0.13889]	[1.99663]	[-0.11789]
D(LN_GDP(-1))	0.627763	0.060401	-1.316168	-2.659802	13.41888	-1.423780	-19.29662	3.349500
	(1.68048)	(0.13139)	(1.08450)	(4.71514)	(46.7437)	(1.86890)	(40.8401)	(4.45045)
	[0.37356]	[0.45971]	[-1.21362]	[-0.56410]	[0.28707]	[-0.76183]	[-0.47249]	[0.75262]
D(LNPE(-1))	-0.487785	0.031670	0.270133	-0.974854	-25.99923	0.318379	12.47178	-0.178939

	(0.29338)	(0.02294)	(0.18933)	(0.82318)	(8.16059)	(0.32628)	(7.12993)	(0.77697)
	[-1.66263]	[1.38066]	[1.42676]	[-1.18426]	[-3.18595]	[0.97579]	[1.74921]	[-0.23030]
D(LE(-1))	-0.156713	-0.012251	0.016693	-0.138545	-4.844098	-0.060014	-1.006589	0.129738
	(0.08876)	(0.00694)	(0.05728)	(0.24904)	(2.46882)	(0.09871)	(2.15702)	(0.23506)
	[-1.76565]	[-1.76543]	[0.29143]	[-0.55633]	[-1.96211]	[-0.60799]	[-0.46666]	[0.55195]
D(INF(-1))	-0.008750	0.000721	0.003026	0.034176	-0.126717	0.010468	0.389286	0.019252
	(0.00642)	(0.00050)	(0.00414)	(0.01801)	(0.17852)	(0.00714)	(0.15598)	(0.01700)
	[-1.36337]	[1.43627]	[0.73050]	[1.89782]	[-0.70981]	[1.46652]	[2.49582]	[1.13268]
D(ODR(-1))	-0.375508	-0.022510	0.093796	-0.108911	-8.297777	-0.131687	4.339878	0.146724
	(0.19827)	(0.01550)	(0.12795)	(0.55631)	(5.51503)	(0.22050)	(4.81850)	(0.52508)
	[-1.89392]	[-1.45208]	[0.73304]	[-0.19577]	[-1.50457]	[-0.59722]	[0.90067]	[0.27943]
D(RIR(-1))	-0.003824	-0.000916	-0.005230	0.037833	-0.194496	0.007710	0.364836	0.039774
	(0.00875)	(0.00068)	(0.00565)	(0.02456)	(0.24349)	(0.00974)	(0.21274)	(0.02318)
	[-0.43683]	[-1.33794]	[-0.92577]	[1.54035]	[-0.79878]	[0.79199]	[1.71495]	[1.71569]
D(YDR(-1))	0.144170	-0.002046	-0.061267	0.098409	2.559908	-0.074617	-1.664246	0.096219
	(0.08078)	(0.00632)	(0.05213)	(0.22665)	(2.24690)	(0.08984)	(1.96312)	(0.21393)
	[1.78476]	[-0.32398]	[-1.17526]	[0.43419]	[1.13931]	[-0.83059]	[-0.84775]	[0.44978]
C	0.165349	0.030971	0.132526	0.455438	5.763220	-0.090847	-2.342408	-0.736621
	(0.10244)	(0.00801)	(0.06611)	(0.28742)	(2.84931)	(0.11392)	(2.48945)	(0.27128)
	[1.61418]	[3.86693]	[2.00473]	[1.58459]	[2.02267]	[-0.79745]	[-0.94093]	[-2.71534]
R-squared	0.502617	0.796913	0.368135	0.535937	0.699622	0.247299	0.636138	0.732779
Adj. R-squared	0.273056	0.703180	0.076505	0.321754	0.560986	-0.100102	0.468202	0.609446

Sum sq. resids	1.154736	0.007059	0.480920	9.090871	893.4330	1.428203	682.0075	8.098853
S.E. equation	0.210744	0.016477	0.136003	0.591311	5.861980	0.234373	5.121626	0.558117
F-statistic	2.189469	8.501987	1.262335	2.502242	5.046459	0.711854	3.787976	5.941478
Log likelihood	13.29536	112.6930	30.37591	-26.94093	-116.4030	9.150722	-111.1374	-24.68774
Akaike AIC	-0.015147	-5.112462	-0.891072	2.048253	6.636053	0.197399	6.366023	1.932704
Schwarz SC	0.539374	-4.557941	-0.336552	2.602773	7.190574	0.751919	6.920543	2.487225
Mean dependent	0.028424	0.039918	0.155219	0.102564	0.205128	-0.051282	-0.128205	-0.692308
S.D. dependent	0.247175	0.030244	0.141525	0.717997	8.847181	0.223456	7.023193	0.893068
Determinant resid covariance (dof adj.)	4.80E-08							
Determinant resid covariance	1.87E-09							
Log likelihood	-50.85639							
Akaike information criterion	9.582379							
Schwarz criterion	15.38352							

APPENDIX VI: NORMALIZED COINTEGRATING COEFFICIENTS

LN_GDS	LN_GDP	LNPE	LE	INF	ODR	RIR	YDR	Constant
1	4.03914	-0.40259	-0.36897	-0.02274	-0.10221	-0.00831	0.122907	-116.8875
	(0.5291)	(0.1327)	(0.03207)	(0.00342)	(0.07226)	(0.00478)	(0.0194)	

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