PRIVATE SAVING-INVESTMENT NEXUS IN RWANDA
(1980-2016)

BY

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DECLARATION

This research paper is my original work and to the best of my knowledge, it has never been presented for the award of a degree in any other university.

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APPROVAL

This research paper has been submitted for examination with my approval as a university Supervisor:

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LIST OF ACRONYMS AND ABBREVIATIONS

ADF : Augmented Dickey-Fuller
ARDL : Autoregressive Distributed Lag
BRICS : Brazil, Russia, India, China, and South Africa
CA : Current Account
CV : Critical Values
Dr. : Doctor
ECM : Error Correction Model
ECT : Error Correction Term
FDI : Foreign Direct Investment
FPCIs : Foreign Private Capital Inflows
GDP : Gross Domestic Product
GIIN : Global Impact Investing Network
GoR : Government of Rwanda
GTZ : Deutsche Gesellschaft für Technische Zusammenarbeit
IMF : International Monetary Fund
LBCs : Local Business Communities
LDCs : Least Developed Countries
MICs : Middle Income Countries
MINECOFIN : Ministry of Finance and Economic Planning
ML : Maximum Likelihood
NGOs : Non-Government Organizations
OECDCs : Organization for Economic Co-operation and Development/countries
OLS : Ordinary Least Squares
PGDS : Private Gross Domestic Saving
PGFCF : Private Gross Fixed Capital Formation
PP : Phillips-Perron
RDB : Rwanda Development Board
RSE : Rwanda Stock Exchange

SACCOs : Savings and Credit Co-operatives

SAP : Structural Adjustment Program

SBC : Schwarz Bayesian Criterion

UNCTAD : United Nations Conference on Trade and Development

VAR : Vector Auto-Regressive

VECM : Vector Error Correction Model

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ABSTRACT

The purpose of this study was to empirically examine the nature of the relationship between private saving and private investment in Rwanda. To achieve this purpose, we adopted the long-run generic model of saving and investment initiated by Feldstein and Horioka (1980) which was later modified in order to come to an improved specification that captures the study variables. Previous studies focused just on the aggregate domestic saving-investment relationship and no attempt was made to the disintegration of the total domestic saving-investment relation into their sub-components. Such analyses are critical as they would guide the possibility for countries to reassess their policy framework for investment. Hence, the contribution of this study was to fill this gap by investigating the nexus between Private Gross Domestic Saving (PGDS) and Private Gross Fixed Capital Formation (PGFCF) in Rwanda using the lately developed bounds test approach to cointegration. Cointegration test statistics showed that PGDS and PGFCF were co-integrated for Rwanda when PGFCF served a responding-variable. The ARDL technique indicated a tiny little correlation (0.08) between PGDS and PGFCF for Rwanda implying heavy dependence of PGFCF on foreign private saving, in the period under study. VECM tests statistics showed unidirectional long-run influence running from PGDS to PGFCF. The long-run empirical findings indicated that PGDS matters for PGFCF and therefore, this study suggests that government should implement policies aimed at removing obstacles to PGDS acceleration in order to influence PGFCF in Rwanda.

CHAPTER ONE: INTRODUCTION

1.1 Background of the study

The link between national saving and investment has been the focal point of the scholars and policymakers in the Global North and South. The driving force of these debates has been whether domestic saving acceleration is the surest way and quickest road of improving domestic investment. The literature argues that the foundation for sustained economic growth thrives well in an environment where it is domestic saving that attempt to keep up with local investment.

Feldstein and Horioka, (1980) initiated the debate over the link among domestic saving and investment. They examined the degree to which a high level of domestic saving rate can be related to domestic investment for the Organization for Economic Cooperation and Development (OECD) countries. They claimed that, with unbounded capital mobility across country borders, there should very little or no correlation at all between countries' saving rates with investment rates. In their view, saving generated in any given country would leave it to seek out the greatest rate of return on investment elsewhere, after allowing for potential risks (Feldstein and Horioka 1980; Case et al. 1996). Therefore, an improved domestic saving rate does not necessarily go with an improved rate of domestic investment in the country in question.

However, Feldstein and Horioka, (1980) findings contradicted the wide held belief that capital is mobile globally given the abolition of its control. The findings indicated almost full saving retention coefficients within OECD countries rather than the other way round. As such, they concluded that capital was immobile irrespective of the worldwide investment opportunities. This inconsistency between theory and empirical findings is referred to, in the economic literature, Feldstein and Horioka puzzle.

Feldstein and Horioka puzzle have spawned several theoretical and empirical studies. One strand of thought offers the alternative hypothesis that elucidates the association between the aforementioned series irrespective of the extent of cross-border capital mobility. Under this strand, the nexus between saving and investment follows from the other exogenous economic factors such as banking sector, types of economic system (Wang 2013), technological progress, (Herwartz and Xu 2010), financial crisis (But and Morley 2017), current account targeting (Bayoumi 1990) and the like rather than cross-border capital mobility.

The other strand of ethos speaks up for Feldstein and Horioka model as a way of measuring the extent of cross-border capital mobility as a result of capital control removal. Feldstein and Horioka (1980) conclusion was re-tested by several studies using sophisticated estimation techniques and large sample data. The overwhelming majority of these studies revealed two significant outcomes: (1) the correlation between saving-investment for small income countries is quite low, (see, for example Chakrabarti, 2006; Mitra 2015; and Henrickson and Herzog 2015) as against that of larger income countries and (2) the estimate of correlation coefficients of saving on investment become slightly lower as more current age data is employed (see, for example, Narayan 2005, Kim et al. 2007, Cavallo and Pedemonte 2016). This can be explained by the greater capital mobility across countries.

It is worth noticing that despite the big amount of studies devoted on the analysis of the association between both national saving and investment no attention has been paid to the decomposition of the overall saving-investment association into their sub-components. Such analyses are invaluable as they would guide the possibility for countries to reassess their private investment promotion strategies. Therefore, the core of this study was to fill this lacuna by examining private saving investment nexus in Rwanda as it holds the key for sustainable national economic growth and poverty reduction.

1.1.1 Brief overview of private saving and investment in Rwanda

Private investment is the seed corn of sustainable national economic growth and poverty reduction in any economy. Private investment creates adequate fruitful investment opportunities, encourages efficiency in economic growth, social success by involving energetically more people in the production process and thus increasing tax base which is important for addressing social challenges (see, for example, International Finance Corporation 2000, Bayraktar 2003). As a result, one of the pillars of Rwanda's vision 2020[1] consists of promoting a private investment-led economy, aimed at accelerating its development agenda towards the middle-income country (MIC) status by the year 2020 with at least private investment ratio to GDP of 18.2 by the year 2018.

[1] Represents long term development strategy to transform the country into a middle income economy by the year 2020.

The above economic outcome requires a high rate of financing to match it. Rao, (2010) pointed out that while foreign private capital inflows (FPCIs) have been helpful in the advancement of development, it is out of the question for any country to make reasonable progress in the absence of national investment based on national saving. Domestic saving depends on society's willingness to encourage thrifty. However, it is often said that thrifty may depress investment instead of encouraging it. This claim is founded on the idea that the private sector's capital and consumption is fixed, which is not the case for countries with scarce capital relative to other resources (labor and land). The meagre stock of physical capital, in these countries, hampers both labor and land productivity. Furthermore, the literature indicates that the primary cause of unemployment in the Global South is the absence of resources for people to work with (see, for example, Lewis 2013).

Hence an increase in thrift would generate more capital to current and aspiring businessmen if conditions are, of course, favorable to them. Case et al., (1996) argued that scarcity of capital in the Global South may have more to do with a lack of incentives for thrift and investment opportunities rather than any absolute scarcity of income available for saving. Therefore, the quality of a country's policy intervention is essential to ensure a saving-friendly environment. In Rwanda, the expansion of private saving has been traditionally impeded by poor saving culture, poor access to banking facilities, low growth of income, (MINECOFIN 2012, Malunda 2012), and high young dependency ratio (World Bank Groups 2015).

Much was done in terms of financial liberalization, financial literacy[2], financial inclusion[3], financial competition[4], pension reform, micro-finance institutions/MFIs, (MINECOFIN 2013), and youth economic empowerment among others by the current government in order to unlock the supply of finance. For example, in an effort to stimulate saving rate among the unbanked population, the government rolled out 416 Umurenge savings and credit cooperatives commonly known as Umurenge SACCOs in 2009. All of the above-mentioned initiatives were devised in order to address the pre-mentioned key impediments to private saving acceleration in Rwanda.

[2] Rwanda established the National Financial Education in 2011 with purpose of deepening and broadening Rwandan's financial literacy. Lewis indicated that lack of skill can not only presents people from utilizing capital productively, but may also prevent them from utilizing it at all.
[3] The overall financial inclusion according to MINECOFIN (2013) increased from 47% in 2008 to 72% in 2012 and the Umurenge SACCOs role as a government initiate has significantly played a key in improving financial inclusion.
[4] The banking industry in Rwanda witnessed new entrants of foreign banks namely Kenya Commercial Bank and Equity Bank in 2008 and 2011 respectively.

Despite the above strenuous initiatives to promote saving in Rwanda, private saving ratios to GDP remained very low, averaging around 2.7 ratios of GDP, from 2000 to 2016. On the other hand, however, private domestic investment ratios remained above the private domestic saving ratio, both to GDP, over the studied time period, averaging at 9.2 ratios of GDP. The excess of private investment ratio over private domestic saving ratio to GDP have been financed by FPCIs. Rwanda had performed stupendously in creating a good business environment for large-scale inward foreign companies. As a matter of fact, Rwanda led the 2010 world in Doing Business reforms where it was ranked 67 out of 143countries, third in Sub-Sahara after Mauritius and South Africa and first in East Africa.

In their study, Abbott and Malinda, (2011) argued that the Government of Rwanda (GoR) has gone out of its way to proffer tax incentives and exemptions to large-scale inward foreign firms. However the above achievements and initiatives have yet to be rewarded with sufficient foreign investment inflows (Gökgür 2012, Ggombe and Newfarmer 2017 and World Bank Group 2018) suggesting a low level of productive capacity.

Several factors which have been constraining private investment expansion in Rwanda have been cited in several studies. In his study, Gökgür, (2012) argued that the market concentration of the ruling party/state-owned companies[5], failure of privatization programme and meagre FDI are responsible for the low level of private investment in Rwanda. The same source reveals that the ruling party/state-owned companies and those that possess close ties to the top bras enjoy preferential treatment and protected economic opportunities (see also, Rayarikar 2017). Rajagopalan, (1996) showed that vertical inequality in political power access among tycoons and potential entrants not only blocks entry, it also harms growth. Therefore, there is a need to reduce ruling party/state intervention in resource allocation and thus making room for the free market to take off.

In their studies, Bowan, (2015) and Ansoms and Rostagno, (2012) cited frequent arbitrary tax, inconsistent application of tax incentives, poor access to affordable finance, and heavy regulation respectively as the major factors which impede the engagement of small-scale capital actors into

[5] Throughout this paper the term party/state owned companies will refer to the companies that are owned either full or partially by the ruling part together with directly or indirectly owned by the GoR, directly and indirectly owned by the military and ruling party connect business elite as suggested by Gökgür, (2012).

formal or informal activities. Last but not least, in their survey, the GIIN and Open Capital Advisors, (2015) and GTZ, (2008) cited over-regulation which starts just after registration, preferential treatment, too much involvement of government officials in private investment deals among others and high cost of compliance with both taxes and regulatory requirements respectively as the major barriers to private investment expansion in Rwanda.

All of the above-mentioned impediments would definitely dampen investors' responses to government policies and reforms. One major drawback of the above constraints is to limit the share of the other operators in the national income as competition is mainly limited to large-scale companies and thus derailing emerging inclusive growth and pro-poor policy, (Gökgür 2012, De Mello and Dutz 2012). Therefore, there is a need for government to relax its hold on local business communities by reducing the red tape. We believe that any government policy aimed at scaling up the rate of private domestic saving without providing a fruitful framework for its best use is a trip to nowhere. Government policies to respond to the above assertion are dead in the water. Thus, this study sought to put forward policy recommendations based on the findings to help the GoR to provide a fruitful framework for the best use of private saving and thus unlocking private investment-led economy.

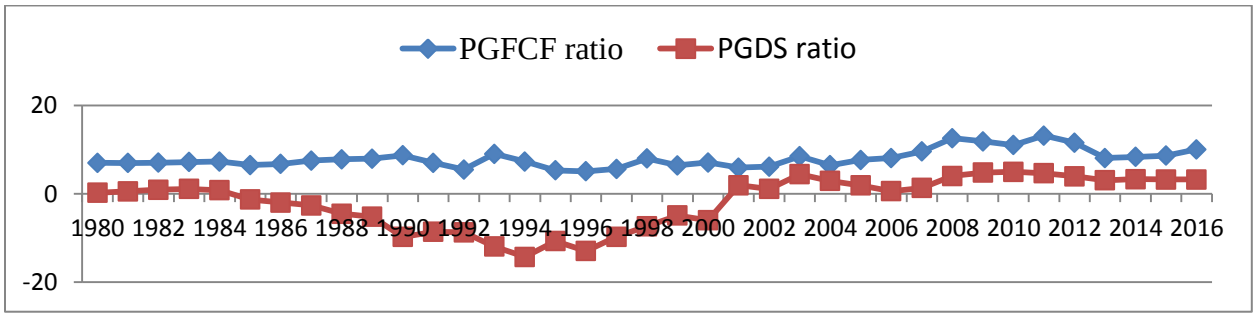

Figure 1: Trend of Private Gross Domestic Saving (PGDS) ratios and Private Gross Fixed Capital Formation (PGFCF) ratios to GDP for Rwanda.

To start with, in the run-up to 1980, the Rwandan economy was impressive and has notched up an annual growth rate of 4.7% and a reasonable debt and fairly stable currency. However, the economy started to slacken in the mid-to-late 1980s due to the slump in both prices of coffee and tin internationally[6] which, in turn, led to an economic crisis. Going back to the study variables;

[6] Coffee, tin and tea are Rwanda's main largest foreign earners

PGDS ratio[7] remained constant from 1980 to 1983 following the above-aforementioned fluctuations of commodity price on the international market. The said ratio, however, slackened progressively from 1984 until it had hit rock bottom in 1994, following the prolonged collapse of commodity prices, failure of structural adjustment program (SAP); increase in military expenditure[8] as well as capital flight resulted from both macroeconomic and political crises which culminated to the genocide against Tutsi in 1994. All of these led to the destruction of the country's capital base.

After the above aforementioned dismal performance, the current government played a major part in restoring PGDS ratio through extensive economic reforms and initiatives such as rebuilding infrastructure, overhaul of institutions and commercial laws, re-establishment of sound macroeconomic, financial and trade liberation, financial literacy, establishment of an economic advancement programme known as vision 2020 in 2000, pension reforms and many more that gave rise to the improvement in PGDS ratio, (Malunda 2012). The humanitarian community had also played a meaningful role in recovering PGDS ratio. As a matter of fact, NGOs were the second-largest employment offer in Rwanda in 1996 (Porter 2006). Following the above initiatives, on the average, PGDS ratio improved from negative 12.97 in 1996 to 4.43 in 2003.

From 2003 to 2006, PGDS ratios declined from 4.43 to o.59 and this could be attributed partly to the unfavorable weather conditions, decline in the values of exports together with an increase in oil price internationally. From 2006 to 2008 the considerable improvement in PGDS ratio could be attributed to the increase in the value of export and favorable weather conditions. From 2008 to 2010, PGDS ratio has improved slightly following the efforts of the government to unburden local enterprises from costly regulations through reforms; consolidating all investment government-related agencies to institute Rwanda Development Board (RDB) to proffer all investment relates services, as well as the introduction of the national saving mobilization strategy aimed at amassing the much-needed capital for productive investment. However, in the subsequent years (2012-2016), PGDS ratio remained flat, signaling its remarkable recovery from the massive disruption caused by political and economic crises.

[7] PGDS ratio or just PGDS is defined as $PGDS/GDP * 100$. The data on both PGFCF and PGDS ratios were sourced from National bank of Rwanda.

[8] The increase in the military expenditure was due to liberation war between 1990 and 1992.

On the hand, PGFCF ratio[9] evolved constantly with an average ratio to GDP of 9.2 although, they were an ups and downturns due to economic and non-economic upheavals. For example, PGFCF ratio has plummeted in 1990 as a result of the war and in 1994 as a result of genocide against Tutsi. From 2005 to 2008 the considerable improvement in PGFCF ratio was accompanied by increase in FDI following the revival of investors' confidence, tax incentives, and the efforts of the government to unburden local business community from high costly regulations. From 2008 to 2010 a decline in PGFCF ratio was mainly due the financial crisis that broke out in developed countries in 2007/2008 gave rise to a reduction in the propensity to invest on behalf of foreign investors. In 2012, PGFCF ratio slickened due to the dramatic decline in FDI following the allegations of United Nations of political interference in the Democratic Republic of the Congo. Furthermore, following the improvement in the diplomatic relationship, FDI rebounded which in turn impacted positively PGFCF ratio in the subsequent years.

1.2 Problem statement

One of the pillars of Rwanda's vision 2020 consists of promoting a private investment-led economic growth, aimed at accelerating its development agenda towards the middle-income country (MIC) status by the year 2020 with a per capita GDP of US$ 1,240. A key factor for achieving the above target is an expansion in PGFCF ratio. This assertion has been empirically examined and confirmed by several recent studies (see, for example, El-Seoud 2014; Nwakoby and Bernard, 2016). Therefore, one of the critical challenge faced by many emergent nations like Rwanda, when attempting to attain the desired level of per capita income, is to increase PGFCF ratio, (IMF 2000).

The above challenge can be addressed through effective internal and external mobilization of the required financial resources (see, for example, Raza 2015; Gui-Diby 2014). However, small and resource-poor economies, like Rwanda, are less successful in attracting more inward investment (see, for example, Gökgür 2012) as most of them are attracted by bigger and resource-rich economies, (see, for example, Jaspersen et al. 1995, Rao 2010; UNCTAD 2013; Lewis 2013and Xiaofang 2013). The GIIN and Open Capital Advisors (2015) and Malunda, (2012) argued that Rwanda remains to be among the lowest recipients of foreign private capital in East Africa.

[9] PGFCF ratio or just PGFCF is defined as $PGFCF/GDP * 100$.

Given the limited role played by FPCIs in scaling up PGFCF ratio, there was a need for the people of Rwanda to ensure that much of the needed saving, for productive investment, was wrung from them. To achieve the above, good development governance to orchestrate the move was critical. As such, the GoR undertook several reforms and initiatives such as financial reforms, pension reforms, and trade liberalization among others to boost domestic saving. Despite the above reforms and initiatives, the current PGDS ratio, in Rwanda, remained significantly much lower (averaging around 2.7 ratios of GDP from 2000 to 2016) and thus its contribution to PGFCF ratio, over the period of study, turned out to be critical. Therefore, this study sought to offer policy options based on the findings to help in improving PGDS ratio in Rwanda.

1.3 Research questions

In light of the above problem statement, this paper sought to address the following set of questions:

1. What is the nature of the relationship between private saving and private investment in Rwanda?
2. Does the conventional view that private saving thrives private investment hold in Rwanda?

1.4 Objectives of the study

The general objective of this study was to examine private saving-investment nexus in the Rwandan economy.

Specifically, the study sought to:

1. Investigate the short and long-run association between private saving and private investment in Rwanda.
2. Examine the causality between both private saving and investment in the Rwandan economy.
3. Offer policy recommendations based on the study findings.

1.5 Significance of the study

The current trend of PGFCF ratio remains to be very low, despite reforms and efforts made by the GoR. The inability to generate a high ratio of PGFCF to GDP constitutes one of the greatest economic challenges of the GoR to climb to MIC status. Despite the above, government should

honor its commitment regarding private investment-led boom. Hence this study sought to offer policy recommendations to improve the said ratio. While most previous studies have entirely focused on the association between aggregate national saving and investment ratios, this study aimed at studying private saving-investment nexus in Rwanda. Such analysis is critical, say, in evaluating how investors respond to government policies and reforms. The findings revealed what is needed to be taken into consideration in order to improve the correlation between the two series.

Finally, this study offers a helping hand to those who want to move the debate forward in the area of this study. The choice of Rwanda as a case study was governed by its relatively low level of private investment. In addition to that, the current efforts and initiatives to improve private investment are dead in the water. Thus, this study sought to offer policy recommendations based on the findings to guide policy interventions.

1.6 Structure of the study

Following this introduction is chapter two which presents briefly the related literature; chapter three exposes methodological approach and the data; chapter four reports the empirical evidence and discussions while the last chapter presents summary, conclusion, and recommendations.

CHAPTER TWO: LITERATURE REVIEW

2.1 Introduction

The enormous empirical studies cast light on the link between home saving and investment. This chapter discussed briefly the literature on both theoretical and empirical on saving and investment relationship.

2.2 Theoretical Literature Review

In this study we considered the following three distinct theories to explain the association between national saving and investment:

2.2.1 Feldstein and Horioka puzzle

International macroeconomic literature expounds that in unbounded global financial markets; domestic saving can easily flow from its origin country to those countries that proffer the highest anticipated rate of private return, after allowing for the potential risks (see, for example, Carbaugh 2005). Feldstein and Horioka, (1980) examined empirically the aforementioned postulate for 16 OECD nations using cross-sectional data (1960-1974). According to them, the lower share of domestic saving to investment (δ)[10] the higher of it is financed by foreign saving and vice versa. Their results revealed almost full saving retention coefficients within the said nations. They concluded that capital was rather immobile, thereby leading to what is commonly known, in the economic literarure, as Feldstein and Horioka, (1980) puzzle.

2.2.2 Neoclassical approach

Neoclassical economic models advocate that investment is positively related to real rental cost of capital. The higher is the rental cost, the lower the capital stock and thus the higher the marginal product of capital. As such, capital would flow from high income to poor income nations in searching for the higher rate of return on investment (see, for example, Henrickson and Herzog 2015). Under this model, an improvement in the rate of saving would give rise to gradual decline in the real cost of capital and thus increasing the firms' investment (ESSO and Yaya 2010). Therefore, policies aimed at mobilizing both domestic and foreign savings are essential to thriving domestic investment.

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[10] $\frac{I_t}{Y_t} = \emptyset + \delta\frac{S_t}{Y_t} + \mu_t$, where: $\frac{I_t}{Y_t}$ and t, $\frac{S_t}{Y_t}$ are explained in section 3.2 of this paper while μ_t and $\emptyset$ are the error and constant terms respectively. The coefficient of $\frac{S_t}{Y_t}$ $(\delta)\epsilon[0-1]$ represents the level of a country's self-financing.

2.2.3 Current-account solvency constraint

This theory suggests that the current account deficit cannot be granted through unlimited capital inflows. It follows that domestic investment can be funded by means of borrowing at the world's rate of interest (R_t) plus the price of holding that risk. An increasingly growing rate of capital inflows suggests an overwhelming debt burden to bear, which is not granted forever. This is because foreign suppliers of funds tend to impose penalties to non-solvent country borrowers by adding on the world interest rate a larger share of risk premium. This will definitely decline access to foreign capital and thus imposing domestic saving and investment ratios to be co-integrated with almost a unit coefficient (Coakley et al. 1996).

2.3 Empirical Literature Review

In their influential paper published in 1980, Feldstein and Horioka delved into the association between national saving and investment ratios encompassing 16 OECDCs by employing cross-section data spanning 1960 to 1974 and found robust association between the study variables. They advocated that there was the absence of cross-border capital mobility among the study countries. Their study laid the groundwork for a new way of measuring cross-border capital mobility.

Cooray and Sinha, (2007) inquired into the association between saving and investment ratios by employing ordinary least square (OLS); Full modified OLS; Johansen Maximum Likelihood (ML); Fractional cointegration tests and yearly data for different data samples. Cointegration test statistics pointed towards favoring steady-state equilibrium between the study variables only for two states namely Rwanda and South Africa over 20 states. The fractional co-integration test advocated that national saving and investment ratios were ascertained to be fractionally co-integrated for 12 countries[11]. The evidence of some capital mobility was found in four countries[12]. However, the mixed estimates were found for four countries (Ethiopia, Mauritius, Malawi, and Nigeria).

Nindi and Odhiambo, (2014) employing ARDL and ECM, looked into the link and direction of influence between national saving and investment in Malawi (1973-2011). The study evidences

[11] Algeria, Egypt, Niger, Morocco, Rwanda, Senegal, Burundi, South Africa, Swaziland, Tanzania, Tunisia and Zimbabwe.
[12] Which are Cote d'Ivoire, Kenya, Lesotho and Sierra Leone.

indicated a permanent unidirectional causal influence flowing from investment to saving. In addition to that, the findings pointed towards the mutual transitory association between the two series. Similarly, Mitra, (2015), delved into saving and investment link in the Philippines (1960-2014) using both Johansen co-integration and ECM techniques. The estimates from both techniques failed to provide compelling evidences against the absence of a relationship between the study series.

Kónya, (2015) studied the nature of the link between saving and investment ratios in the BRICS member states, in line with the Feldstein–Horioka hypothesis, using time series data for different data samples, OLS, ARDL model, and Pearson correlation. The estimates suggested biased estimates for each BRICS member state. However, Pearson correlation coefficients revealed that capital was not fully mobile within BRICS countries but it was substantially mobile in some of these countries namely South Africa and Russia compared to the remaining countries.

Nasiru and Usman, (2013) delved into the link between saving ratio and investment ratio, in Nigeria spanning 1980 to 2011, employing ARDL procedure and ECM technique. The evidences were in favor of a permanent relationship between the studied series. The results also indicated negative and significant error correction coefficient (-1.11) at 1 percent significant level.

Georgopoulos and Hejazi, (2005) using panel data and an extended simple equation of saving and investment to incorporate home bias, looked into the link among saving and investment ratios in 28 OECD countries (1970–2000). The findings revealed an indication of home bias associated with investor utility maximization but tend to fall through time.

In a rather similar study, Coakley et al., (1999) used the Johansen test as well as ECM to investigate saving-investment relationship in 23 OECDCs and 44 LDCs spanning 1965 to 1990. The statistical estimates from both (LDCs and OECDCs) are in favor of long-run solvency constraint. However, the structural coefficient for LDCs is lower than that of OECDCs as a result of policy responses.

Ogbokor and Musilika (2014), by employing Johansen test for cointegration, studied the bond among national saving and investment in Namibia by employing data spanning 1995 to 2011 and the results were not in favor of cointegration between the studied variables. These results, according to them, suggested high cross-border capital mobility. However, a unidirectional of

influence running from saving to investment was found. Narayan (2005) delved into the association and direction of influence between saving and investment ratios by employing ARDL and bootstrap approach respectively for Japanese economy from 1960 to1999 and found the evidence of cointegration and bidirectional causal influence between the study variables.

2.4 Overview of the literature review

The three distinct theories reviewed are essential in this study because they provide useful theoretical explanations under which saving and investment are to be co-integrated and under what circumstances these two variables diverge. Under these theories, an improved rate of domestic saving is anticipated to be significantly and positively correlated with an improved rate of domestic investment at least in the long run. The current study follows Feldstein and Horioka, (1980) approach to examine private saving-investment nexus in Rwanda.

Despite the vast studies devoted to the aforementioned puzzle, there is no unanimous consensus about the link between saving and investment. Economic literature provides several explanations for the above-mentioned puzzle. Some of these reasons include data insufficiency, mixed modeling, and estimation techniques. It is worth noticing that, some of these studies (see, for example, Cooray and Sinha 2007; Feldstein and Horioka1980) have excessively emphasized on the cross-sectional data which may not be able to puzzle out reasonably the country's specific matters.

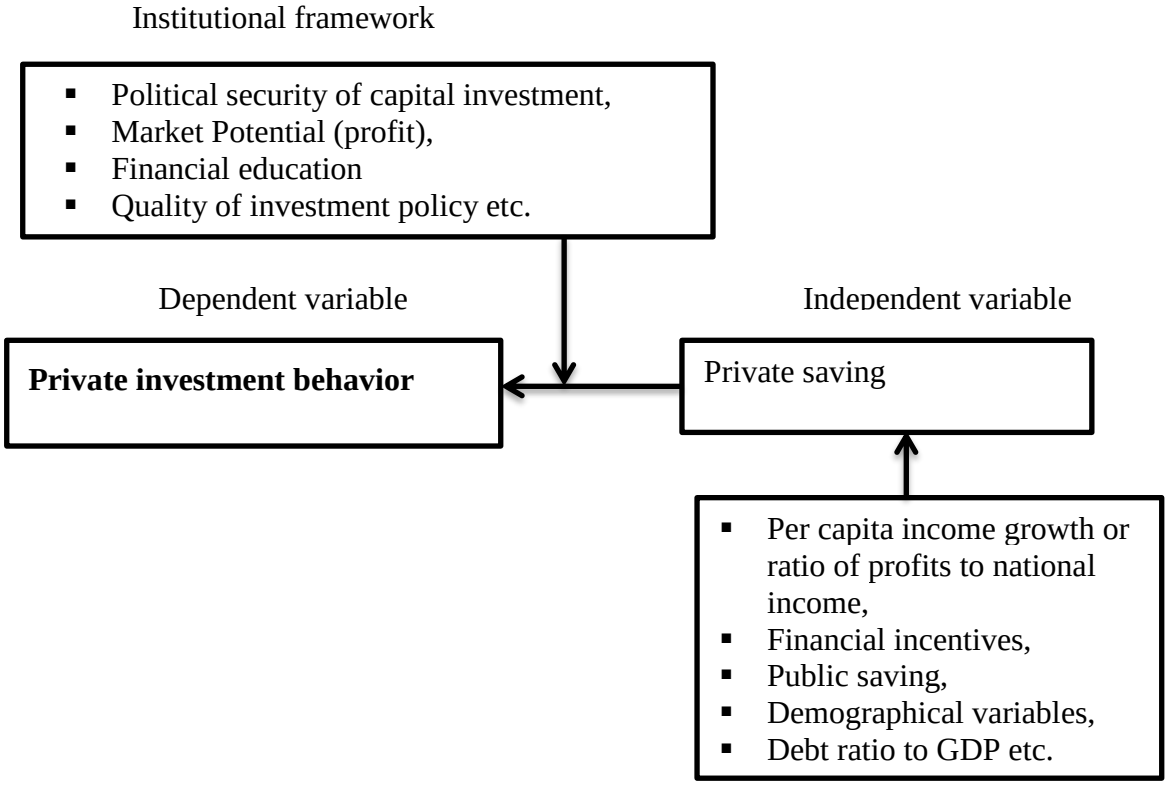
In our study, we addressed the above issue by focusing exclusively on Rwanda, as a case study. Furthermore, most of these studies (see, for example, Cooray and Sinha 2007, Cooray and Sinha 2007) used OLS as an estimation technique. Given the fact the empirical results are proven to be sensitive to the estimation methods (Krol 1996), an improvement in the estimation techniques would lead to a more efficient, unbiased and consistent estimates. Therefore, in this study we used the new testing procedure to co-integration namely ARDL bounds test to investigate the link between PGFCF and PGDS ratios.

Above all, the existing empirical literature examined just the link between the overall national saving-investment. However, the empirical literature remains silent about the disintegration of overall saving-investment relation into their sub-components. Thus, this study enriches the existing literature by examining private saving-investment nexus in Rwanda.

2.5 Conceptual Framework

Figure 2 represents the conceptual framework which shows the link between the study variables. The framework generally states that individuals have the moral duty to make the best use of the available resources and thus making surplus for future use. Private investment ratio is a dependent variable. The framework indicates that factors such as per capita income growth/ratio of profits to national income, financial incentives, public saving and demographical variables and debt ratio to GDP determine the independent variable. The framework also indicates that institutional framework such as political security of capital investment, market potential, financial education and quality of investment policy is essential to encourage initiatives and risk-taking as shown below.

Figure 2: Conceptual framework



Source: Author compilation based on economic literature (Jaspersen et al. 1995, Loayza et al. 2000 and Lewis 2013, to name just few).

CHAPTER THREE: METHODOLOGY

3.1 Introduction

This study examined private saving-investment nexus in the Rwandan economy spanning 1980 to 2016. This chapter described the methodological approach and data employed in the current study.

3.2 Economic model

The econometric model of the current study was built around the generic long-run equilibrium model of saving and investment initiated by Feldstein and Horioka, (1980). The model can be specified as following, given the appropriate deterministic model components:

$$(I/Y)_t = \delta(S/Y)_t, \ldots \ldots \ldots \ldots \ldots (1).$$

Where: $(I/Y)_t$ represents national investment ratio at time t, $(S/Y)_t$ refers to national saving ratio at time t, δ is the saving retention coefficient. A lower estimate of δ (i.e. closer to zero) would show that a greater share of domestic investment is funded by foreign saving which implies evidence for capital mobility for the country in question. In an attempt to realize the objectives of this study, I/Y and S/Y, in equation one (1), were disintegrated into their sub-components, in order to come to an improved specification that captures the study variables as follow:

$$(GI/Y + PI/Y)_t = \delta(GS/Y + PS/Y)_t, \ldots \ldots \ldots \ldots \ldots (2).$$

Where: GI: government investment ratio PI: private investment ratio, GS: government saving ratio, and PS: private saving ratio and t: time. The model (2) ignored the fundamental properties of transitory saving-investment dynamics. A key postulation of the model 2 is that there is no government dissaving $\left(i.e. (GI/Y)_t - \delta(GS/Y)_t = 0\right)$.

3.3 Empirical model

By incorporating the above assumption in the model (2) we got the following specification equation of private investment and private saving ratios relationship:

$$PGFCF_t = \gamma_0 + \emptyset_1 PGDS_t + \varepsilon_t, \ldots \ldots \ldots \ldots \ldots (3).$$

Where ε_t represents uncorrelated error term, γ_0 and $\emptyset_1$ are the parameters to be estimated, $PGFCF$: Private Gross Fixed Capital Formation ratio as a proxy for PI/Y, while $PGDS$: Private Cross Domestic Saving ratio as a proxy for PS/Y, $\emptyset_1 > 0$ and varies between 0 and 1.

3.4 Data type and source

The study adopted time series annual data on PGDS and PGFCF consisting of 37 observations from 1980-2016. The data for both study variables were obtained from the National Bank of Rwanda, monetary policy department (2017). Our study focused on gross variables instead of net of depreciation, by right of the wise reasons explained in Feldstein and Horioka, (1980) paper.

Table 1: Description of the study variables and expected sign

Series	**Description of the study variables and their measurements**	Expected Sign
PGFCF	Private Gross Fixed Capital Formation measured as $PGFCF/GDP * 100$ as a proxy for $PI/Y * 100$.	Dependent variable
PGDS	Private Gross Domestic Saving is measured as $PGDS/GDP * 100$ as a proxy for $PS/Y * 100$.	+

Source: National Bank of Rwanda, monetary policy department (2017).

3.5 Bounds test of cointegration

This study applied the recent Autoregressive Distributed Lag (ARDL) approach to cointegration, also known as bounds test of cointegration, initiated by Pesaran and Shin, (1999), and Pesaran et al., (2001) to investigate the nature of the relationship between PGDS and PGFCF for Rwanda. This technique was chosen as a result of its relative superior performance when: (i) sample size is relatively small, (ii) predictor variable(s) is/are exclusively $I(0)$ or $I(1)$ or a blend of $I(0)$ and $I(1)$ and (iii) predictor variable(s) is/are endogenous. ARDL approach to cointegration further allows for discovering a number of co-integrating vector(s) in a system of equation. A serious weakness with this technique, however, is that it is inappropriate when the multiple level relationships are found within a system of equation. Following Pesaran and Shin, (1997) and Nindi and Odhiambo, (2014), an ARDL framework equation (3) can be re-parameterized to error correlation model (ECM) as follow as:

$$\Delta PGFCF_t = \theta_0 + \theta_1 t + \emptyset_1 PGFCF_{t-1} + \emptyset_2 PGDS_{t-1} + \sum_{i=1}^{k} \emptyset_{3i} \Delta PGFCF_{t-i} + \sum_{i=0}^{k} \emptyset_{4i} \Delta PGDS_{t-i} + \epsilon_{1t}, \ldots \ldots (4a).$$

$$\Delta PGDS_t = \theta_0 + \theta_1 t + \gamma_1 PGDS_{t-1} + \gamma_2 PGFCF_{t-1} + \sum_{i=1}^{k} \gamma_{3i} \Delta PGDS_{t-i} + \sum_{i=0}^{k} \gamma_{4i} \Delta PGFCF_{t-i} + \epsilon_{2t}, \ldots \ldots (4b).$$

Where Δ represent the first difference operator; θ_0: constant term; θ_1 represents the coefficient of time trend, $\emptyset_1$ and $\emptyset_2$ or γ_1 and γ_2 represent the coefficients for the lagged variables (correspond to the steady state equilibrium relationship); $\emptyset_{3i}$ and $\emptyset_{4i}$ or γ_{3i} and γ_{4i} represent the coefficients for transitory effects; ϵ_{1t} and ϵ_{2t} are the white noise disturbances in the equation $4a$ and $4b$ respectively, while k represents the optimal number of lags.

The ARDL bounds test approach to cointegration comprises three core steps. The first step consists of ascertaining the presence of cointegration among variables under consideration using the bounds test procedure. This entails for testing the following hypothesis for equation $4a$ where PGFCF served as a dependent variable:

H_0: $\emptyset_1 = \emptyset_2 = 0$ (i.e. non-existence of a long-run relationship).

H_1: $\emptyset_1 \neq \emptyset_2 \neq 0$ (i.e. existence of a long-run relationship).

On the other hand, when PGDS served as a dependent variable ($4b$), the null and the alternative hypotheses were defined as follow:

H_0: $\gamma_1 = \gamma_2 = 0$(i.e. non-existence of a long-run relationship).

H_1: $\gamma_1 \neq \gamma_2 \neq 0$ (i.e. presence of a long-run relationship).

The above hypotheses were tested by employing the Wall-test (F. statistic). Then, the computed Wall-test statistics were compared with bounds test critical values (CV) obtained from Narayan (2005) paper varying from 30 to 80 observations. Two sorts of CV (lower and upper critical bounds) are provided. The lower bounds sort regards that all series are $I(0)$ while the upper bounds type assumes that all the series are $I(1)$. When the calculated Wall-test statistic exceeds the $I(1)$ CV, H_O cannot be accepted. Otherwise, H_O cannot be rejected (see, for example, Nkoro and Uko 2016).

Given the fact that the evidence of co-integration was found in favor of a single co-integrating vector (equation $4a$), as shown in table 5, the second step was to select the optimal lag order using Schwarz information (SI) and Hannan-Quinn (HQ) criterions. The last step involved the estimation of elasticities of both long and short-run of the co-integrating vector.

3.6 Diagnostic tests

OLS estimation technique can only hold if its assumptions hold. Therefore, the estimates of the steady-state equilibrium and that of a dynamic model of the co-integrating vector passed the necessary diagnostic tests, in order to assure that the error term satisfied the usual OLS assumptions:

3.6.1 Unit root tests

Unlike the traditional approach to cointegration techniques, the ARDL approach to cointegration does not necessitate pre-testing for the presence of a unit root in order to look into the existence of cointegration among the series under-investigation (Pesaran et al. 2001). However, it is advisable to indicate that the study series are not integrated of an order that is more than one (1) before undertaking the bounds test of cointegration (Nkoro and Uko 2016). As such, this study employed both Augmented Dickey-Fuller (ADF) and Phillips Perron (PP) tests, as the largest prominently employed in the literature, to investigate whether series possessed a unit root or not. The lag-lengths were selected using SC and HQ criterions.

3.6.2 Normality test

The parametric tests reckon that data follows a normal distribution, (Ghasemi and Zahediasl 2012). This test helped us to establish whether data display serious deviance from normality. The visual method (Jarque-Berra-JB test) was employed to test for normality distribution. Hypothesis testing, H_0: residuals follow a normal distribution whiles the alternative H_1: H_0 is not true.

3.6.3 Autocorrelation test

Adequacy of the model calls for the absence of residual autocorrelation, (Monti 1994). The auto-correlation test was carried out using the Breusch-Godfrey test with a view to ensuring the adequacy of the models.

3.6.4 Parameter stability

The stability of the parameters is essential for the inference to be stable. The Ramsey's reset test was used as it was suggested (see, for example, Pesaran 1997) to test the instability of the parameters. Hypothesis testing: H_0: the first-order conditions are mean zero while the H_1 : Parameter instability.

3.6.5 Stability tests

CUSUM and CUSUM of squares tests, through the use of graphical representations, were employed to check the instability of the models. When the boundaries, of the aforementioned tests, lie within the limits of the critical bounds at 5 percent level of significance, H_0 which states that the model is correctly specified cannot be rejected. Otherwise, H_0 is rejected.

3.7 Framework for the long-run elasticities

The estimates of the long-run elasticities within the ARDL framework were generated by the following equation 5 :

$$PGFCF_t = \theta_0 + \sum_{i=1}^{k} \theta_1 PGFCF_{t-i} + \sum_{i=0}^{k} \theta_2 PGDS_{t-i} + \varepsilon_t, \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots (5).$$

Where: θ_0 is a constant term; k is the maximum number of lag order while ε_t is the white noise disturbances.

5.8 Framework for short-run elasticities

One way of solving the spurious regression resulted from regressing non-stationary series is to difference the series under investigation. The regression of the differenced series generates to us the transitory behavior of the parameters of the model under investigation. However, this outcome does not serve the main concern of the researchers who are generally interested in long-run equilibrium outcome of the variables in question. This can be solved by the theory of co-integration and the ECM, (Nkoro and Uko 2016). With the framework of ECM, We then have both short and long information in one model. The cointegration equation $4a$ was employed to generate the ECT. The conditional ECM linked with a level relationship was given as follow:

$$\Delta PGFCF_t = \theta_0 + \sum_{i=1}^{k} \beta_{1i} \Delta PGFCF_{t-i} + \sum_{i=0}^{k} \beta_{2i} \Delta PGDS_{t-i} + \delta ECT_{t-1} + \epsilon_t, \ldots\ldots\ldots\ldots\ldots\ldots (6).$$

ECT stands for speed of adjustment at which the deviance from the steady-state equilibrium value is adjusted at the moment. A high negative coefficient of the lagged ECT implies the more rapid adjustment process and the steady long-run equilibrium relationship, (see Bannerjee et al. 1998; Shittu et al. 2012). The statistical significance of β_{2i} implies short-run correlation among the study variables.

3.9 Granger causality framework

The lack of compelling evidence of long-run feedback effect (Table 5) implies long-run causal influence running from PGDS to PGFCF. On the other hand, lack of compelling evidence of cointegration between PGDS and PGFCF, when PGDS served as a dependent variable (Table 5), implies no long-run causal effect running $PGFCF$ to $PGDS$ but it doesn't rule out short-run causal influence between the two series. Therefore, in this part of the study, we were concerned about the short-run causal influence flowing from PGFCF to PGDS. The following framework was employed in order to determine the short-run causal influence between $PGDS$ and $PGFCF$:

$$\Delta PGDS_t = \alpha_0 + \sum_{i=1}^{k-1} \gamma_{1i} \Delta PGDS_{t-i} + \sum_{i=0}^{k-1} \gamma_{2i} \Delta PGFCF_{t-i} + \varepsilon_{1i} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (7a).$$

Where, ε_{1i} is the serially independent random errors, α_0 is a constant term, $k-1$ is the optimal lag length reduced by one (1) and γ_{1i} and γ_{2i} are the parameters to be estimated where, γ_{2i} represents the short run causal influence running from PGFCF to PGDS. The the statistical significance of the short-run causal influence was ascertained using t-test. These entailed testing the following hypothesis, $H_0: \gamma_{2i} = 0$ implying no short-run causal influence while the alternative hypothesis H_1: H_0 is not true.

CHAPTER 4: EMPIRICAL RESULTS AND DISCUSSIONS

4. 1 Summary statistics

Table 2 presents the summary statistics of the series employed in the current study. The results of the summary statistics indicated that PGFCF is positively skewed suggesting that the underlying distribution has long right tails while PGDS is negatively skewed. The results also indicated that the PGDS variable follows a normal distribution while the Jarque-Bera (JB) statistic rejects the null hypothesis of a normal distribution for PGFCF variable. The key results are summed up descriptively in Table 2.

Table 2: Descriptive statistics

	PGDS	**PGFCF**
Mean	-1.826328	7.977458
Median	0.594069	7.517894
Maximum	4.987893	13.20046
Minimum	-14.32562	5.079599
Std. Dev.	5.793744	2.006665
Skewness	-0.671792	1.004091
Kurtosis	2.130153	3.444681
Jarque-Bera	3.949522	6.522076
Probability	0.138794	0.038349
Observation	37	37

Where, Std. Dev stands for standard deviation.

4.2 ADF and PP tests results

Table 3 showed that both PGDS and PGFCF were not stationary in levels. Hence, the variables are not stationary at levels. However, after being differenced once, both series became stationary. Thus PGDS and PGFCF series were stationary and integrated of the same order one.

Table 3: Results of unit root tests

Variables	**ADF tests**		**PP tests**		**Comment**
Variables at level	**No-trend**	**With trend**	**No-trend**	**With trend**	
PGFCF	-2.012	-2.684	-2.273	-2.964	Unit root
PGDS	-0.878	-1.594	-0.964	-1.563	Unit root
Variables at the first difference					
Δ(PGFCF)	-6.730***	-6.629***	-6.730***	-6.629***	Stationary
Δ(PGDS)	-6.379***	-6.495***	-6.379***	-6.495***	Stationary

Where ***denote the conventional levels of significance of 1%.

4.3 Estimation of the ARDL framework equations

One of the key prerequisites for calculating F-test statistics is to run the ARDL framework equation $4a$ and $4b$ using OLS. The appropriate lag for each equation is one as show in Table 12, in the appendix. The estimates of these two equations are reported in Table 4 together with various diagnostic test estimates based on disturbances.

Table 4: Estimates of the ARDL frameworks

Estimates of the equation $\boldsymbol{4a}$ Responding-variable: PGFCF			Estimates of the equation $\boldsymbol{4b}$ Dependent variable: PGDS		
Explanatory variables	Coefficients	t-statistics [P_values]	Explanatory variables	Coefficients	t-statistics [P_values]
C	4.053785	3.0062 [0.005]	C	0.3695	0.17098 [0.865]
@trend	0.042632	1.3971 [0.173]	@trend	0.0984	2.01258 [0.0535]
PGFCF(-1)	-0.576555	-3.2142[0.003]	PGDS(-1)	-0.08679	-1.0288 [0.3121]
PGDS(-1)	0.095107	1.8064 [0.081]	PGFCF(-1)	-0.29445	-1.02433 [0.314]
Δ(PGFCF(-1))	0.099694	0.5557 [0.583]	Δ(GDS(-1))	-0.1435	-0.78258 [0.440]
Δ(PGDS(-1))	-0.069743	-0.6095 [0.547]	Δ(PGFCF(-1))	0.2941	1.0228 [0.315]
$R^2 = 0.29$; $F-statistics = 2.392$; $Prob(F-statistic) = 0.0621$; $DW = 1.9596$			$R^2 = 0.16077$; $F-statistics = 1.11115$, $Prob(F-statistic)$: 0.376135; DW: 2.00057		
Diagnostic test statistics : (1) Serial correlation: $\chi^2_{AUT}(2) = 0.549[0.625]$ (2) Heteroscedasticity: $\chi^2_{BP}(5) = 0.723[0.763]$ (3) Functional form: $\chi^2_{RESET}(1)$=0.4651[0.517] (4) Normality χ^2_{NORM}= 2.908590[0.234]			**Diagnostic test statistics :** (1) Serial correlation: $\chi^2_{Auto}(2) = 0.2122[0.2859]$ (2) Heteroscedasticity: $\chi^2_{BP}(5) = 0.3179[0.347]$ (3) Functional form: $\chi^2_{RESET}(1) = 0.107[0.153]$ (4) Normality : χ^2_{NORM}= 5.3871[0.0676]		

Notes: (1) $\chi^2_{AUTo}(2)$, $\chi^2_{HTR}(5)$, (3) χ^2_{RESE}, χ^2_{NORM} are the chi-squared test statistics to detect for autocorrelation(Breusch-Godfrey Serial correlation LM test); Heteroscedasticity (Breusch-Pagan-Godfrey) and function form misspecification (Ramsey RESET test) and non-normality (Jacque-Berra) respectively, R^2: adjusted R-squared; and (6) DW: Durbin-Wotson test statistic.

4.4 Results of ARDL approach to cointegration

The next step consisted of comparing the F-test statistic of joint coefficients of the lagged series for the equation $4a$ and $4b$ respectively against their corresponding CV for the bounds test. The results of calculated F-test together with CV for the bunds tests were reported in Table 5.

Table 5: F-test statistics and critical values for bounds test

Dependent variable	Function	Lags	Wald/F-test statistic	
PGFCF	$F_{PGFCF}(PGFCF/PGDS)$	1	5.285321*	
PGDS	$F_{PGDS}(PGDS/PGFCF)$	1	1.829697	
			Critical Values (CV) at 10%	
Narayan, (2005) Table case IV			I(0)	I(1)
			4.380	4.867

Note: CV were taken from Narayan (2005), case IV: unrestricted intercept and unrestricted trend with one regressor (k=1). *denotes statistical significance at 10 percent. k: a number of regressors.

As shown in Table 5, when $PGFCF$ served as a responding-variable, the calculated F-test statistic (5.285) is greater than the I(1) (4.867) at 10% level of significance. This suggested that the H_0 $(i.e.\ \emptyset_1 = \emptyset_2 = 0)$ of the non-existence of a long run association between PGDS and PGFCF is rejected for Rwanda, in the period under study. In other words, the results advocated the presence of a long-run equilibrium relationship between the study series when PGFCF served as a responding-variable. This finding is consistent with those of Narayan, (2005); and Nasiru and Usman, (2013) who found evidence of a long-run association among national saving and investment ratios when investment served as a dependent variable. However, the H_0 $(i.e.\ \gamma_1 = \gamma_2 = 0)$ is accepted, when PGDS served as a responding-variable, as the F-test statistic (1.829697) is less than the I(0) (4.380) for bounds test.

4.5 Long-run and short-run coefficients estimates

Having found that the cointegration existed between PGDS and PGFCF while the hypothesis of one co-integrating vector cannot be rejected (Table 5), the application of ARDL approach to cointegration became a viable option (see, for example, Nkoro and Uko 2016, Pesaran et al. 2001). The maximum lag of one was selected as shown in Table 8 in the appendix. The co-integrating vector (equation 5) and its reparameterization into ECM (equation 6) were estimated using OLS methodology and the key results were reported in Table 6.

Table 6: Estimates of the long/short-run elasticities based on ARDL (1,1)

Long-run elasticities			
Regressors	**Coefficients**	**t-statistics**	**P-values**
C	3.423748***	3.005000	0.0050
PGDS	0.084874*	1.838512	0.0750
PGFCF(-1)	0.598575***	4.428705	0.0001
$R^2 = 0.523;$ DW $= 2.018766;$ F $-$ statistics $= 20.22031$ prob(F $-$ statistics) $= 0.000002$			
Diagnostic test statistics for long run model			
(1) Serial correlation: $\chi^2_{AUT}(2) = 0.3189[0.362]$			
(2) Heteroscedasticity: $\chi^2_{HT}(2) = 0.7799[0.7950]$			
(3) Functional form misspecification: $\chi^2_{\text{RESET}}(1)$=0.17121[0.2005]			
(4) Non-normality errors: χ^2_{NORM}= 2.708024[0.258202]			
Short-run estimates			
Regressors	**Coefficients**	**t-statistic**	**P-values**
Δ(PGFCF(-1))	0.589699*	2.004426	0.0538
Δ(PGDS)	-0.038222	-0.358555	0.7224
ECT(-1)	-1.04990***	-3.041182	0.0048
$R^2 = 0.20;$ DW $= 2.08574$			
Diagnostic test statistics for short run model			
(1)Serial correlation: $\chi^2_{Auto}(2) = 0.1733[0.2029]$			
(2)Heteroscedasticity: $\chi^2_{BP}(3) = 0.9333[0.9421]$			
(3)non-normality errors : χ^2_{norm}= 2.530408[0.282182]			
(4)Functional form misspecification: $\chi^2_{\text{RESET}}(1)$=0.7938[0.8077]			

Where: $\chi^2_{AUTo}(2)$, $\chi^2_{\text{HTR}}(5)$, (3) χ^2_{RESE}, χ^2_{NORM}, and DW: were explained in Table 4, R^2: adjusted R-squared, p-value indicated in [.], *, **, ***denote(s) significance levels (10%, 5% and 1% respectively).

The estimates of the elasticities for both long and short-run models passed diagnostic tests to make certain that the error term satisfied the usual OLS assumptions. The diagnostic test statistics, as reported in Table 6, advocated no evidence for serial correlation, heteroscedasticity, normality errors, and functional form misspecification. Furthermore, the CUSUM and CUSUM of squares test results, as shown in figure 3 and 4, for long and short-run models respectively, advocated that the regression coefficients were normally stable under the study period.

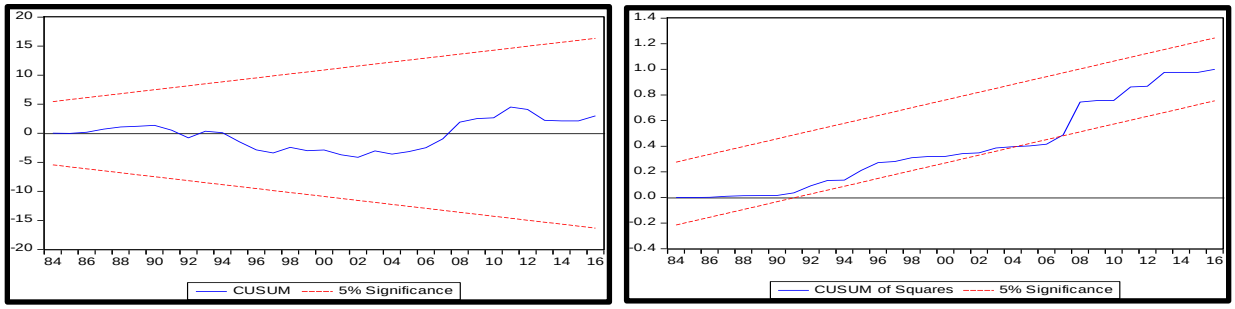


Figure 3: CUSUM and CUSUM of Squares visual tests for long-run model

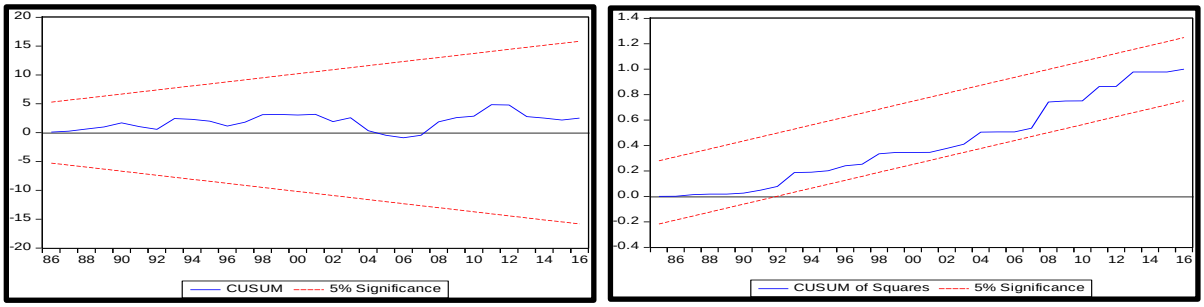


Figure 4: CUSUM and CUSUM of Squares visual tests for short-run model

Table 6 presents the estimates of both long and short-run elasticities as well as their corresponding diagnostic test statistics. The estimates of the long-run elasticities were all statistically significant and positively correlated as expected. ARDL test statistic showed a tiny little correlation (0.08) between PGDS and PGFCF, implying heavy dependence of PGFCF on foreign private saving under the studied period. In other words, ceteris paribus, a 1 percent change in PGDS led, on average, to 0.08 percent increase in PGFCF over the studied period. Although, our result differs from that of Cooray and Sinha, (2007) who found that gross domestic saving and investment were negatively correlated for Rwanda from 1968 to 2003.

The possible explanation for tiny little correlation between PGDS and PGFCF could be the approach adopted by the GoR in its efforts to promote private investment-led economic growth, which emphasized more on tax expenditures to large inward foreign firms (Abbott and Malinda 2011) and less on creating friendly environment to local business communities (An Ansoms and Rostagno 2012). This approach was adopted in the presumption that it could eventually crowd in domestic investment. While this was well grounded in theory, a mounting number of empirical studies indicated that domestic investment is a precursor to FDI (see, for example, Al-Sadig 2013, UNCTAD 2013).

Two splendid reasons were provided in UNCTAD, (2013) paper to adequately underpin the above argument: (1) the local business community has more information on investment climate and thus its actions send signals to the rest about the affair of the economy, (2) policies to promote domestic investment are actually the same policies to entice foreign investors. It is therefore reasonably fair to expect that the opposite could exclusively happen by means of poor allocation of the public scarce resources or abuse of power. As a matter of fact, the findings

revealed that tax expenditures are among the least inducements for investment decision in East Africa countries (see, for example, Mwachinga 2013, Biau and Pfister 2014).

Consequently, the aforementioned approach yielded very little, if any, benefit to the local productive capacities. Taken together, these discussions suggest that country should entice inward investment when it would best benefit the development of local productive capacities. Above all, real economic reforms must be hinged on views, needs, and aspirations of the people and more importantly on bottom-up rather than paternalistic/copied one, as it has been the case for Rwanda (see, for example, Ayittey 2017). Internalizing this naked truth is important for orchestrating the move towards sustainable economic growth and mass poverty reduction which remain to be a dream in the Global South, Rwanda includes. In fact, there is no two ways about that.

The conditional ECM estimates were also reported in Table 6. The equilibrium adjustment coefficient is negative $1.05[0.005]$ and highly statistically significant. This result seemed to corroborate the evidence of a long-run association between PGDS and PGFCF, (See, for example, Shittu et al. 2012). The coefficient of negative 1.05 $(i.e.-1.05)$ advocates that the previous year deviance from the steady state equilibrium value is corrected in the current period at the speed of 105 percent. Meaning that 105% of the deviation between actual and equilibrium PGFCF is corrected approximately one (1) year, evincing a high rate of adjustment to the equilibrium. The coefficient of Δ(PGDS) is -0.04 $[0.7224]$ but statistically insignificant which posits that, in the short-run, PGFCF, over the studied period, has been mainly financed by foreign saving. This result corroborates the reasonable theoretical prediction which stipulates that private investment activities, in the short-run, can be underwritten by the worldwide pool of capital.

4.6 Granger causality test statistical results

The results of VECM-based causality, as shown in Table 7, confirmed the presence of a long-run causal influence running from PGDS to PGFCF for Rwanda as the lagged coefficient of ECT is greatly statistically significant. In other words, PGDS Granger caused PGFCF for Rwanda in the period under study. This empirical result is consistent with that of Ogbokor and Musilika, (2014) and Tsoukis and Alyousha (2001) who found that saving influenced investment in the long-run. The lack of significant long-run feedback effect between PGDS and PGFCF (Table 5) implies

prior PGDS matters for PGFCF. That is to say that, in order to stimulate PGFCF in Rwanda, more efforts should be directed to saving mobilization strategies, rather than investment-promotion. The empirical findings failed to provide compelling evidences against the H_o of no temporary causal effect between PGDS and PGFCF running from PGFCF to PGDS. The lack of a transitory causal effect between the two series, as shown in Table 7, implies PGDS and PGFCF were not related under the period of study.

Table 7: Causality test results

Responding-variable	**Causal flow**	**t-statistics [P-value]**		
		D(PGFCF)	D(PGDS)	ECT_{t-1}
D(PGFCF)	PGDS→PGFCF	-	-	-3.222[0.003]***
D(PGDS)	*PGFCF→PGDS*	0.495[0.624]	-	-

Notes: *** indicates statistical significance level at 1 percent.

CHAPTER FIVE: SUMMARY, CONCLUSIONS, AND RECOMMENDATIONS

5.1 Summary and conclusions

The purpose of this study was to empirically delve into the nature of the linkage between private saving and private investment in Rwanda spanning 1980 to 2016. To achieve this purpose, we adopted the long run equilibrium model of saving and investment initiated by Feldstein and Horioka, (1980) and disintegrated saving and investment association into their sub-components in order to come to an improved specification that captures study variables. This study, as an initial attempt, took advantage of the newly developed ARDL approach to cointegration developed by Pesaran et al., (2001) to examine the nature of the link between $PGDS$ and $PGFCF$. We also ascertained the causal effect between the two series by means of VECM.

To start with, the Current trend of PGFCF, as shown in Figure 1, does not warrant Rwanda to climb to MIC status by the year 2020. In fact, it looks like fighting a losing battle by trying to do so. Both ratios (PGDS and PGFCF) have been less responsive to policies and reforms over the studied period. This could be explained by the tiny enterprise sector which has been benefiting from the status quo and thus blocking new entry. This conclusion is in the line with that of Ansoms and Rostagno, (2012) and Rayarikar, (2017) who argued that the robust economic growth of Rwanda is concentrated in the hands of the chosen few (ruling elites).

In order to avoid ARDL model crash which occurred normally when the series in question are integrated with the order greater than one (1), the ADF and PP tests were performed and the results concluded that (PGFCF and PGDS) series were integrated with the order one/($I(1)$ as shown in Table 3. The estimates of bounds test approach to cointegration, as indicated in Table 5, showed that the H_o of no evidence of a long-run association between PGDS and PGFCF cannot be accepted for Rwanda when PGFCF served as a responding-variable, as the computed F-test statistic (5.285) exceeds the $I(1)$ CV of 4.87 at 10 percent level of significance. This implies that there was a long-run connection between $PGDS$ and $PGFCF$ for Rwanda, in the period under study.

The estimates of the long-run elasticities indicated a tiny little correlation (0.08), implying that PGFCF relied heavily on external sources of financing which raises a concern for long-term

sustainability. In other words, the efforts to generate a reasonable PGFCF ratio based on PGDS ratio, had miserably failed. This can be partly due to the fact that the policies to encourage PGDS did not take into account its best use. Granger Causality test statistics (as shown in Table 7) showed unidirectional long-run influence running from PGDS to PGFCF for Rwanda over the studied period. The empirical findings failed to provide compelling evidences against the null hypothesis of no temporary causal effect running from PGFCF to PGDS. The lack of significant transitory causal effect between the two series advocated that PGDS and PGFCF were not related for Rwanda. All in all, the empirical findings, in this study, strongly support Feldstein and Horioka, (1980) hypothesis.

5.2 Policy recommendations

In light of the above conclusion, we recommend the following:

Given the current trend of PGFCF, GoR should revisit its policy framework for investment as to galvanize more investors of all size into action, through various incentives.

The long-run empirical findings indicated that PGDS matters for PGFCF in Rwanda and therefore, this study recommends that policies aimed at removing impediments to PGDS acceleration, in a sustainable manner, should be implemented. That is to say that GoR should focus more on pro-private saving policies in order to stimulate PGFCF.

The empirical findings indicated that PGFCF relied heavily on foreign capital which raises a concern for long-term sustainability and therefore, GoR should confront this problem by relaxing its hold on local business communities (LBCs) while attracting inward investment to fill the gaps, in terms financial and technology, left by the LBCs.

The empirical findings revealed a very weak correlation between PGDS and PGFCF which could be explained by the lack of a fruitful framework for best use of available saving and thus generating disincentive to save. Therefore, GoR should focus on policy interventions that provide incentives for saving mobilization strategies via cheapest structure, say second-hand machinery, second-hand clothes and so forth which will do the job, boosting firm profits and more importantly ensuring a fruitful framework for best use of saving generated throughout in order to improve the correlation between the two series.

If the debate is to be moved forward, a better understanding of the forces that determine distinctly private saving and investment in Rwandan economy needs to be developed.

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