ECONOMIC MODELLING OF CAPITAL MARKET AND INVESTMENT SUSTAINABILITY IN RWANDA.

A CASE STUDY: CAPITAL MARKET AUTHORITY

A Thesis Submitted to the University of Rwanda, College of Business and Economics in Partial Fulfillment of the Requirements for the Award of a Master Degree of Master of Science in Economics

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Approval Sheet

This thesis entitled **"Economic Modelling of Capital Market and Investment Sustainability in Rwanda"** written and submitted by **Christian MBABAZI NAHAYO** in partial fulfilment of the requirements for the degree of **Master of Science in Economics** is hereby accepted and approved.

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Director of Graduate Studies

_____

Date

I. DEDICATION

I devote this Research Project to The LORD who always sustain me in my daily academic mission. Moreover, I dedicate to my Darling wife Jeannette and my Cherished son Carsten. I dedicate it again to my Supervisor Dr. Martin MUGENZI and Dear Mrs. Bernadette GATAMBIRA RENARD.

II. DECLARATION

I the undersigned **Christian MBABAZI NAHAYO**, a student at the University of Rwanda, School of Economics, Master of Science in Economics, declare that this thesis entitled ***"Economic Modelling of Capital Market and Investment Sustainability in Rwanda"*** is my own work and it is has not been submitted anywhere for the award any degree.

Kigali, 30th October 2018

Signature……..

Christian MBABAZI NAHAYO

III. CERTIFICATION

It is certified that this Research Project was completed at University of Rwanda, used data were from Capital Market Authority.

It is the work of **Christian MBABAZI NAHAYO**, a student in University of Rwanda, School of Economics under my supervision during this Research Project identified at University of Rwanda.

Supervisor:

Date.....October 2018

Signature.....

Dr. Martin MUGENZI

Lecturer at School of Economics

IV. ACKNOWLEDGEMENTS

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V. ABSTRACT

This research is focusing on economic modelling of capital markets and investment sustainability in Rwanda.

In Rwanda the investment is very highly needed in order to uplift the level of the economy of the country. There are different reasons for instance the costs of transport due to the geographical situation. In this research, the focus is to test the significance of the capital markets on investment at market of Rwanda. The regression model will apply, but, first of all, the graphical presentation will be done all variables of the model; investment, turnover and market capitalization have the trend and intercept while number of shares has the intercept only. In addition, the test of stationarity will follow; whereby, investment and market capitalization are stable on the first difference while turnover and number of shares are stationary at level. These variables are cointegrated. In Error Correction Model there will take 33 months to recover in short. The long run relationship shows that, the model fits at 88%. The Impulse-Responses also determines how the shocks will affect one another.

The capital market needs an important support to raise the investment in Rwanda. Because the findings illustrates its impact positively.

VI. LIST OF TABLES

VII. ABBREVIATIONS AND ACRONYMS

In this research, there are used abbreviations and acronyms, below is the list of them:

ADF: Augmented Dickey-Fuller

BK: Bank of Kigali Plc

BRALIRWA: Brasserie et Limodanerie du Rwanda

BRL: BRALIRWA

CTL: Crystal Telecom

EAC: East African Community

ECM: Error Correction Model

EG: Engle-Granger

EQTY: Equity Bank Group Ltd

ESG: Environmental, Social and Governance

E-Views: Econometric Views

FO: Further Offers

FRW: Rwandan Francs

HY: High Yield

IMR: I&M Bank Rwanda Ltd

INV: Investment

IPOs: Initial Public Offerings

KCB: Kenya Commercial Bank

M&A: Mergers & Acquisitions

MCAP: Market Capitalization

NGO: Non-Governmental Organization

NISR: National Institute of Statistics of Rwanda

NMG: Nation Media Group

PWC: PricewaterhouseCoopers

RDB: Rwanda Development Board

RSE: Rwanda Stock Exchange

SDGs: Sustainable Development Goals

SGX: Singapore Exchange

SHA: Shares

SSA: Singapore Shipping Association

SSE: Sustainable Stock Exchanges

TOV: Turnover

UN: United Nations

UNCTAD: United Nations Conference on Trade and Development

USD: United States Dollar

USL: Uchumi Super Market Ltd

VAR: Vector Autoregression

CHAPTER I: INTRODUCTION

1.1 Background of the Study

Investment is an addition to the stock of capital goods in the public or private sector over a given time period. Gross investment includes both this net investment and the replacement investment to keep the stock intact. Theories of the determination of the volume of investment include the accelerator principle and marginal efficiency of capital approaches. It can be also expressed as the purchase of a financial asset.[1] Furthermore, in economic sense an investment is the purchase of goods that are not consumed today but are used in the future to create wealth.

In fact, while visiting this link (http://rdb.rw/rwanda-development-board-registers-usd-1-675-billion-worth-of-investments-in-2017/) we find that the Rwanda Development Board (RDB) in 2017 registered investments in Rwanda worth $USD 1.675 billion. This is an increase of $USD 515 million when compared to the investments registered by RDB in 2016. In comparison, in 2016, foreign investments worth USD$ 650.4 million, local investments worth USD$ 479.

Basing on the above results, we find the difference of USD$ 171.4, whereby, the domestic investment need to be taken carefully and be so that be improved. The awareness and profitability should be explored and explained to the population and be open their minds and compete on international level.

Furthermore, capital markets and stock exchange will be carried out and tested econometrically in order to verify if they can promote investment in Rwanda at good proportion. The test of its significance using the data since 2011 up to last year 2017 will give us a good shape on investment in Rwandan economy.

[1]Junanker, P.N. (1972) Investment: Theoriesand Evidence, London: Macmillan

1.2 Statement of the Problem

The investment is the key factor in the economy on both developed and developing countries.

As we have seen in the introduction, investment is an addition to the stock of capital goods in the public or private sector over a given time period. Gross investment includes both this net investment and the replacement investment to keep the stock intact. Theories of the determination of the volume of investment include the accelerator principle and marginal efficiency of capital approaches.[2]

In Rwanda the investment remains the issue due to the different reasons for instance the costs of transport due to the geographical situation. Moreover, the effects of the 1994 genocide against Tutsi leads to the least qualified labour comparing to the population. The vision of the country which targeting to increase the domestic production and contribution of the budget rather waiting for outside; this last enforces to increase domestic taxes. It demands large market also either domestic or foreign.

This issue of investment must be solved systematically and plan for short and long term in order to reach to the sustainable investment and development. Diversification and innovation surely play a big role in investment scope rather concentrating on the same principles.

In this research, the emphasis is to test the significance of the capital markets on investment at market of Rwanda. With good results, the recommendations will be provided in order to reach to the sustainable investment and become international market on stock exchanges that will raise the net export to the appraisable level; the balance of payments will no longer be in deficit rather surplus.

[2] Donald Rutherford, *Routledge Dictionary Dictionary of Economics Second Edition*.

1.3 Objectives of the Study

1.3.1 General Objective

The main objective is to demonstrate the role of capital market in order to promote Investment in Rwanda.

1.3.2 Specific Objectives

i. To test the significance of capital markets on investment sustainability in Rwanda.
ii. To evaluate and recommend policies for upholding investment sustainability.

1.4 Research Questions

(i) Do capital markets have statistically significant impact on investment in Rwanda?
(ii) What recommendations should be suggested to maintain the investment which leads to the social welfare?

1.5 Research Methodology

This research will use econometric model with the help of software of E-Views and Stata. The type data used in this research are secondary and provided by Capital Market Authority.

1.6 Research Hypothesis

The capital market can play a big role in promoting investment sustainability in Rwanda.

1.7 Scope of Study

This research is carrying out on Investment in Rwanda through trading of shares in volumes, bonds, turnover and market capitalization. Therefore the consulted area are Capital Market Authority, Rwanda Stock Exchange and NISR . Rwanda is the space which the researcher has chosen to make his study. Lastly, the range and the sample size the period of research analysis is from 2011 to 2017. The data are on monthly frequency which yield the 84 observations.

1.8 Organization of the Study

This study is supposed to be built on five chapters;

Chapter one presents general introduction, background of the study, problem statement, and objective of study, research question, research hypothesis, area and scope of the study, significance of the study, scope of the study (research design) , and the organization of thesis. Chapter two covers the literature review which reviews the results of variable in this area. Chapter three covers the research methodology and data. Chapter four illustrates the application of different commands and regression and analysis. Chapter five is the last one summarizes the previous finds (results) and recommends for improvement.

CHAPTER II: LITERATURE REVIEW

2.1 Overview of investment and its determinants

Investment is one part of income which has not been consumed. It can either be invested or saved. Hereafter, we can see its extension. Note that; Y, C, I and S stand for income, consumption, investment and savings respectively.

$Y=C+I$ **(1)** or,

$Y=C+S$ **(2)** whereas,

$I=Y-C$ **(3)** or,

$S=Y-C$

Investment has a different determinants among them we can say interest rates, expectations, the level of economic activity, the stock of capital, capacity utilization, the cost of capital goods, other factor costs, technological change, and public policy.[3]

- **Interest rates:** greater interest rates can decrease the quantity of investment, while lower interest rates rise it.

- **Expectations:** A variation in the investment changes upcoming production capacity. Therefore, plans to change the capital stock depend crucially on expectations. A firm considers likely prospect trades.

[3] https://open.lib.umn.edu/principleseconomics/.../29-2-determinants-of-investment/

- **The level of economic activity:** Firms need capital to yield goods and services. A growth in the level of production is likely to increase demand for capital and thus lead to better investment. Therefore, a growth in GDP is likely to shift the investment demand curve to the right.

- **The stock of capital:** The size of capital already in use touches the level of investment in two ways. First, because most stock substitute's capital that has depreciated, a bigger capital stock is likely to lead to extra investment; there will be more capital to replace. But second, a more capital stock can tend to diminish investment.

- **Capacity utilization:** This one counts the percentage of the capital store in usage. Because capital generally necessitates downtime for preservation and repairs, the measured capacity operation rate typically falls below 100%.

- **The cost of capital goods:** The demand curve for investment displays the quantity of investment at each interest rate, all other things unaffected. A variation in a variable said constant in drawing this curve moves the curve. One of those variables is the cost of capital goods themselves.

- **Other factor costs:** Businesses possess a variety of choices concerning by what means specific products can be yielded. A factory, for instance, might use an advanced capital aptitude and moderately few workers, or it might use extra workers and fairly a smaller amount of capital.

- **Technological change:** The application of original skills in technology frequently involves new investment. Variations in technology can thus rise the demand for capital. Advances in computer technology have fortified massive investments in computers. The development of fiber-optic technology for transmitting signals has stimulated enormous investments by telephone and cable television corporates businesses.

- **Public policy:** It can have substantial effects on the demand for capital. Such strategies characteristically seek to mark the cost of capital to firms. The Kennedy administration bring together such guidelines in the timely 1960s. First policy, quicker depreciation, permitted companies to depreciate capital assets over an exact small period of time."
  "The second policy was the investment tax credit, which legalized a firm to cut its tax liability by a proportion of its investment throughout a period."

  Though less direct, a third policy for stimulating investment would be a reduction in taxes on corporate profits (called the corporate income tax). The more net profits which means after-tax, it ensures that businesses can hold a countless portion of any return on a speculation.

  A fourth strategy to encourage greater capital accumulation is a capital increases tax rate that permits gains on assets held through a certain period to be taxed at a different rate than other revenue.

After analysing the above listed determinants of investment, the researcher has done a study on how capital market can also determine the investment.

Private investment is an influential progress enabler: delivered in the right way it can generate self or non-employments, build talents, spur improvement, be responsible for essential infrastructure and services, economies enhancement and make stronger standards in public and corporate governance. Investment, together domestic and foreign needs to be scaled up meaningfully in the coming years to contribute to the post-2015 agenda. More investment is not enough, however. It must also be good quality. Even though private finance accounts for the lion's share of capital inflows to developing countries, its influence to improvement is still to completely materialise. The Sustainable Development Goals (SDGs) clearly call for excellence investment to sustain this change.

Tapping the sustainable improvement potential of investment explains increasing the capacity of the domestic economy and the public sector, restructuring framework situations to mark countries beautiful investment destinations, and supporting accountable business conduct along the length of universal supply chains.[4]

Investment policy is not made in a vacuum. It is prepared in a governmental and economic background that, at the international and regional stages, has been knocked over the last decade by a series of catastrophes in the areas of finance, food security and the environment, and that faces persistent worldwide inequalities and social challenges, specifically with regard to poverty alleviation. These crises and challenges are having profound effects on the way policy is shaped at the global level.

- **First**, the economic and financial calamity has stressed a longer-term shift in economic weight from developed countries to developing markets. Global challenges such as food security and climate change, where developing country arrangement is an essential prerequisite for any viable solution, have further added to a greater role for those countries in global policymaking.

- **Second**, the financial crisis in precise has increased the role of governments in the economy, both in the developed and the emerging world.

- **Third**, the type of the experiments, which no country can address in isolation, makes better global management imperative.

[4] 'Investment for Sustainable Development', 2015, 1–12.

- And **fourth**, the worldwide economic and political context and the challenges that need to be spoken – with societal and natural concerns taking center stage – are leading policymakers to redirect on an emerging new development paradigm that places inclusive and sustainable development goals on the similar footing as economic progress and development aims.[5]

According to the Special publication for the third universal forum on funding for development, on investing in Sustainable Development Goals, UNCTAD's Action Plan for Private Investment in the SDGs comprises a range of strategy options to react to the deployment, guiding and effect challenges. However, a concerted push by the international community and by policymakers at national levels needs to focus on a few priority actions or packages.

- **A new generation of investment promotion strategies and institutions:** long term growth plans, whether in infrastructure, community housing or renewable energy, require strengthened efforts for investment upgrade and assistance.

- **SDG-oriented investment incentives:** Investment incentive schemes can be restructured specifically to facilitate sustainable development projects. A change is needed from purely "location-based" encouragements, pointing to rise the effectiveness of a location and delivered at the stage of establishment, towards "SDG-based" incentives, targeting to endorse investment in SDG sectors and conditional upon long run progress.

- **Regional SDG Investment Compacts:** Regional and South-South cooperation can foster SDG investment. Orienting regional collaboration towards the elevation of SDG investment can be particularly operational for cross-border infrastructure development and regional clusters of partnerships operating in SDG sectors (e.g. green zones). This could include joint investment advancement instruments, joint programs to build absorptive capacity, and joint public-private partnership models.

[5] Investment Policy Framework and F O R Sustainable Development, 'INVESTMENT POLICY FRAMEWORK', 2015.

- **New forms of partnership for SDG investments:** Outward investment agencies could develop into sincere business development agencies for investments in SDG sectors in developing countries, rising awareness of investment occasions, facilitating shareholders to link awareness gaps, and practically enable the investment progression.

- **Enabling innovative financing mechanisms and a reorientation of financial markets:** New and existing supporting instruments, such as green bonds or impact investing, merit support and an empowering environment to let them to be scaled up and marketed to the most encouraging sources of capital.

- **Changing the global business mindset and developing SDG investment Expertise:** The popular of managers in the world's financial organizations and large international enterprises. The leading foundations of global investment as well as most up-and-coming businesspersons have a tendency to be intensely influenced by models of commerce, administration and investment that are frequently taught in business institutes. The action design for private investment in the SDGs is intended to assist as a point of reference for policymakers at countrywide and global levels in their discussions on ways and means to implement the SDGs and the formulation of active approaches for investing in the SDGs.

2.2 Capital markets on international level

While visiting this link **(https://www.unenvironment.org/ru/node/20422)** we found the press release as follows: "6 September 2016 - Singapore joined as the latest member of the United Nations Sustainable Stock Exchanges (SSE) Initiative as it hosted the initiative's Fifth Global Dialogue.

Singapore joins 58 other partner stock exchanges, including the London and New York stock exchanges, in the SSE, a UN initiative that inspires sustainable investment and improved ecological, communal and corporate governance (ESG) among the world's stock exchanges.

Singapore Exchange's Chief Executive Officer, Loh Boon Chye, said, "SGX was enchanted to join the SSE Initiative as a Partner Exchange and host to its 2016 Global Dialogue, which is the first time the occurrence is being held in Singapore.

"As a market operator and regulator, SGX is dedicated to leading the sustainability improvement in Singapore's capital market. We look forward to both subsidizing and education from the other partners of this exciting initiative."

Capital markets provide funding for public goods via a range of mechanisms, for example: sovereign debt, which is issued by countries; the multilateral development bonds, which are issued by development banks; and, municipal bonds, which are issued by local authorities. Sovereign debt is one of the asset classes best predisposed to provide the capital to finance global sustainable development needs. The speed and scale of the growth in sovereign debt that was issued to underpin the global financial system during the financial crisis demonstrates that it is possible to secure financing at the speed and scale implied here.[6]

The report states again, in order to catalyze policy makers into developing a set of capital raising plans this, we propose the following actions:

[6] An Aviva and White Paper, 'A Roadmap for Sustainable Capital Markets ':

1. The establishment of a focused group of finance sector chief executives that are willing to take on a high-level advocacy role at a small number of the key meetings with Finance Ministers, and UN negotiators;

2. The publication of a range of research notes tackling some of key questions that the policy makers setting the national and international capital raising frameworks will need to consider. This will also include broker notes setting out why the current performance of the policy makers falls a long way short of moving the markets over a time frame that is supported by the science. These finance sector papers would be provided to the Expert Committee on a Sustainable Development Financing Strategy;

3. The development of a capacity building course that uses the research notes to train policy makers, NGOs and negotiators in governmental and non-governmental organizations on how the capital markets work and how they can be better harnessed to influence sustainable development.

These aims are consistent with the United Nations Environment Programme Inquiry into the Design of a Sustainable Financial System, which we are pleased to be working with.[7]

[7] Aviva and Paper.

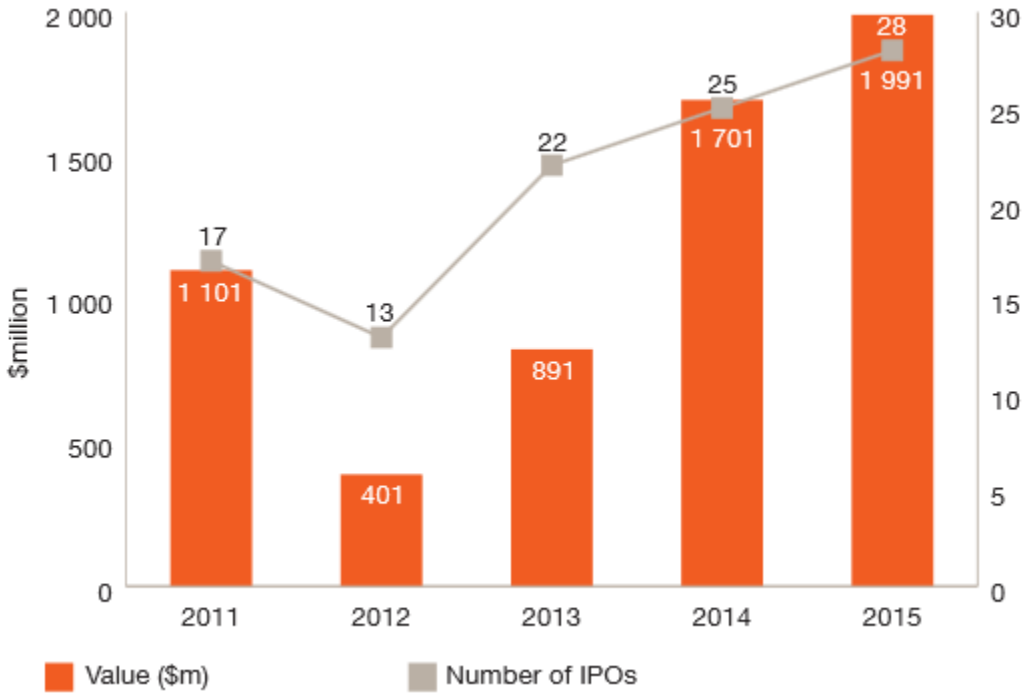
2.3 Capital markets at African level

According to the report done by auditing firm namely PWC, in it 2015 Africa Capital Markets Watch, they have introduced as follows: "This report surveys all new primary market equity initial public offerings (IPOs) and further offers (FOs) by listed companies, as well as high-yield (HY) and investment-grade (IG) debt capital markets activity, in which capital was upraised on Africa's principal stock markets and market segments (including exchanges in Algeria, Botswana, Cameroon, Cape Verde, Côte d'Ivoire, Egypt, Libya, Gabon, Ghana, Kenya, Malawi, Mauritius, Mozambique, Namibia, Nigeria, Morocco, **Rwanda**, Seychelles, Somalia, South Africa, Sudan, Swaziland, Tanzania, Tunisia, Uganda, Zambia and Zimbabwe)."

Furthermore, In 2015, the capital markets, both local and intercontinental, sustained to feature as a primary funding source for the growth, in conjunction with private equity investment and mergers & acquisitions (M&A), reflecting the continued appetite from investors with key portfolio allocations targeted towards emerging and frontier markets. At 31 December 2015, African exchanges had a market capitalization of nearly $1 trillion, with 23% of this value residing on exchanges outside of South Africa.

Over the past five years, there have been 105 IPOs by African companies on both African and international exchanges and non-African businesses in African exchanges, raising $6.1bn. Despite the volatility in global equity markets, companies continue to be attracted to African markets, as established by the stable progress in first-time listings as compared to 2014. There has been an overall increase of 12% in terms of the number of IPOs and 17% in terms of capital raised. During 2015, the top four IPOs by proceeds involved firms or exchanges in North Africa. Each of these listings was oversubscribed, advising healthy investor demand in the region in the first half of 2015.

The said report shows the African IPO trends 2011– 2015



According to the paper written by Vera Songwe, Nonresident Senior Fellow, Africa Growth Initiative entitled as follows: " Africa's capital market enthusiasm: Challenges and prospects for Financing rapid and sustained growth." He identified that African nations have to improve tougher capital market admission. In the short to medium tenure, the task will be to discover new ways of shielding this market access and swelling admissibility to capital markets for sub-Saharan African countries in an economically viable way.

The universal community has an essential role to play here. On a continent where admission to markets is a novel phenomenon and where it is still challenging to interest investors due to inheritance problems of unfortunate macroeconomic management and fiscal correction as well as persistent corruption and fragile institutions, tries to raise capital from the markets is a creditable goal. The prerequisite discipline by the method has no doubt facilitated countries who have been positive in identifying the importance of market observations and the need for better macro-fiscal discipline.

2.4 Capital markets in east Africa community

According to the report done by auditing firm namely PWC, in it 2015 Africa Capital Markets Watch, they stated that, management of East African exchanges and planned collaboration between exchanges (such as the London and Nigerian Stock Exchanges), between others, have permitted these markets to become further liquid and active and to expand turnover ratios.

Countries of the East African Community (EAC) have been following enlargement of capital markets over and done with regional amalgamation. Taking well-operational home-grown capital markets is important for these countries because they need enormous amounts of sponsoring to construct infrastructure for continuous growth. Capital markets are desirable as an substitute foundation of funding, complementing commercial banks, which govern the EAC financial sector with low attractiveness (Gaertner, Sanya, and Yabara, 2011).[8]

Diagnosing the paybacks of capital markets and the boundaries of individual country approaches, the EAC member states are devoted to instituting a common market, which would include free drive of capital under the treaty establishing the community. Furthermore, incorporation of financial markets, in precise government deficit markets, is indispensable for a monetary union to spread common monetary strategy successfully across the region and entirely realize the benefits of a monetary union.[9]

According to the report done by auditing firm namely PWC, in 2016 Africa Capital Markets Watch, they stated that East Africa remains a brighter spot in terms of growth, with a number of countries in the region, such as Ethiopia, Kenya and Tanzania still stationing healthy GDP growth figures of 5.5% or greater, and other oil-importing countries continue to be strong. Côte d'Ivoire, for example, is forecast to be the fastest-growing economy in SSA in 2017, with GDP growth expected to top 8%.

[8] Masafumi Yabara, 'Capital Market Integration : Progress Ahead of the East African Community Monetary Union'.
[9] Yabara.

2.5 Capital markets in Rwanda

Referring to the Rwanda Stock Exchange Report of 2017, they state their vision and mission respectively as follows:

"To be a big contributor to the economic development and key player in leading Rwanda to become a Regional Financial Center."

"To provide the main platform for promotion of savings and raising funds for long term investments in Rwanda and beyond."

2.6 Listed companies in Rwanda Stock Exchange

While visiting the following link (http://www.rse.rw/site/pages/listed+companies/29) we can find the Rwanda Stock Exchange (RSE) - Listed Companies as follows: we find respectively the as stated below:

2.6.1 Listed companies in Rwanda Stock Exchange in banking

Bank of Kigali

Equity Bank Group Ltd

I&M Bank Rwanda

Kenya Commercial Bank

2.6.2 Listed companies in Rwanda Stock Exchange in commercial and services

Nation Media Group (NMG)

Uchumi Super Market Ltd

2.6.3 Listed companies in Rwanda Stock Exchange in manufacturing

BRALIRWA (BRL)

2.6.4 Listed companies in Rwanda Stock Exchange in telecommunication

Crystal Telecom (CTL)

The RSE report continues illustrating the brief description of Rwanda Stock Exchange A Stock Exchange is an ordered and controlled financial market where securities are subscribed and traded at prices administrated by the law of demand and supply. Stock exchanges execute stringent instructions, listing necessities, and statutory requirements that are required on all listed and trading parties. Rwanda Stock Exchange Limited was recognized on 7th October 2005 with the objective of carrying out stock market actions. The Stock Exchange was demutualized from the start as it was registered as a company limited by shares. The company was legitimately launched on 31st January, 2011.

Furthermore, the report shows the structure of Rwanda Stock exchange, the below table clarify in percentage the shareholders.

CHAPTER III: RESEARCH METHODOLOGY AND DATA

3.1 Overview of process on different tests of the research

This research is focusing on economic modelling of capital market and investment sustainability. The researcher will need to illustrate **graphically** all variables in order to verify if the following step of Stationarity test will use either intercept or intercept and trend.

Moreover, **the test of stationarity** on all variables (dependent and independents) will be applied. A type of stochastic process that has received a great deal of attention and scrutiny by time series analysts is the so-called stationary stochastic process. Broadly speaking, a stochastic process is said to be stationary if its mean and variance are constant over time and the value of the covariance between the two time periods depends only on the distance or gap or lag between the two time periods and not the actual time at which the covariance is computed.[10]

Once, the variables are not stationary at their levels; it means that the calculated results are less than the critical results or their probabilities are greater than 5% at 95% of confidence interval and 10% at 90%, those cases will push the researcher to integrate at first difference or second one.

After testing the stationarity, the next step will be **cointegration** testing: we say that the two variables are cointegrated. Economically speaking, two variables will be cointegrated if they have a long-term, or equilibrium, relationship between them.[11] Engle–Granger (EG) will be useful in the test. Here, once the variables are cointegrated, it implies that the model will statistically significant and it can be used to formulate a policy. Otherwise, the researcher should find other alternatives. The **long-run model** will be regressed once cointegration is successfully computed.

Of course, in the short run there may be disequilibrium.[12] This situation, the researcher will be obliged to find a mechanism whereby, it will be solved. This is what we call **Error Correction Mechanism (ECM)** or **Equilibrium Correction Mechanism (ECM)** and it has to possess a negative sign in order to adjust rather than increase the errors. By then, we have to generate residuals because they will used in the regression model.

[10] Basic Econometrics, *As in the Previous Three Editions, the Primary Objective of the Fourth Edition Of*, 2004.
[11] Econometrics.
[12] Econometrics.

Impulse-Responses trace out the responsiveness of the dependent variables in the VAR to shocks to each of the variables. So, for each variable from each equation separately, a unit shock is applied to the error, and the effects upon the VAR system over time are noted. [13] Monte Carlo analysis will be used.

Data have collected from National Institute of Statistics of Rwanda (NISR), Capital Market Authority (CMA) and Rwanda Stock Exchange (RSE). The listed companies in RSE are 8. A half of them are foreigners and another remaining are domestic namely, BK, BLR, NMG, KCB, USL, EQTY, CTL and IMR.

The researcher has used a software of E-Views and Stata to compute the long-run regression model.

3.2 Data for modelling

3.2.1 Trading Statistics on Rwanda Stock Exchange/Equities and Investment

Serial N°	Period	Investment	Volumes (No of shares traded)	Turnover (FRW)	Market Capitalisation (FRW)
	Period	INV	SHA	TOV	MCAP
1	Jan-11	1,001	13,300	2,471,000	819,794,209,914
2	Feb-11	1,001	13,520,700	2,322,132,600	786,365,684,914
3	Mar-11	1,001	10,862,200	1,850,890,200	821,768,802,730
4	Apr-11	1,001	5,060,700	926,733,200	802,551,904,550
5	May-11	1,001	4,649,900	953,005,900	823,123,304,550
6	Jun-11	1,001	6,879,900	1,642,325,700	815,409,029,550

[13] *Introductory Econometrics for Finance SECOND EDITION Chris Brooks The ICMA Centre, University of Reading .*

7	Jul-11	1,001	1,865,000	435,056,500	829,294,724,550
8	Aug-11	1,001	554,000	136,013,100	831,351,864,550
9	Sep-11	1,001	19,818,900	3,089,997,200	940,317,852,550
10	Oct-11	1,001	8,845,500	1,502,763,900	948,950,439,550
11	Nov-11	1,001	33,873,700	4,754,682,100	953,591,339,550
12	Dec-11	1,001	12,288,400	3,195,172,500	960,846,458,550
13	Jan-12	1,212	3,963,600	613,376,800	952,881,208,550
14	Feb-12	1,212	1,346,500	289,612,900	836,358,541,830
15	Mar-12	1,212	2,594,200	448,843,500	829,783,094,830
16	Apr-12	1,212	4,608,800	703,707,400	837,387,111,830
17	May-12	1,212	13,902,300	1,896,914,300	853,844,231,830
18	Jun-12	1,212	18,839,200	3,135,180,600	846,797,293,830
19	Jul-12	1,212	20,719,100	3,351,438,400	874,711,821,920
20	Aug-12	1,212	14,067,200	2,663,737,300	893,421,927,920
21	Sep-12	1,212	1,875,700	360,613,500	946,635,808,372
22	Oct-12	1,212	3,274,700	602,530,700	948,741,847,372

23	Nov-12	1,212	4,043,600	917,310,400	1,062,945,691,370
24	Dec-12	1,212	14,262,000	3,190,947,900	1,069,794,362,280
25	Jan-13	1,311	4,152,700	1,492,085,900	1,150,560,595,642
26	Feb-13	1,311	19,923,200	3,792,330,500	1,197,182,808,642
27	Mar-13	1,311	11,643,300	8,344,166,700	1,234,603,020,642
28	Apr-13	1,311	3,346,800	2,182,619,000	1,242,517,295,642
29	May-13	1,311	23,670,900	9,668,281,700	1,253,369,409,642
30	Jun-13	1,311	3,438,900	2,650,575,800	1,260,981,761,642
31	Jul-13	1,311	1,946,300	1,561,884,300	1,270,765,199,550
32	Aug-13	1,311	5,135,300	3,694,377,700	1,270,096,862,550
33	Sep-13	1,311	10,082,400	6,787,006,300	1,261,612,327,550
34	Oct-13	1,311	14,409,800	9,726,350,100	1,306,919,607,000
35	Nov-13	1,311	7,787,700	2,683,705,400	1,381,253,250,180
36	Dec-13	1,311	2,899,900	1,398,706,600	1,372,667,125,180
37	Jan-14	1,382	12,909,000	5,816,347,300	1,381,911,913,566
38	Feb-14	1,382	11,669,700	3,754,373,200	1,429,885,135,180

39	Mar-14	1,382	44,805,200	2,023,669,452	1,449,685,670,380
40	Apr-14	1,382	1,149,800	447,106,200	1,442,148,401,580
41	May-14	1,382	4,720,700	1,403,665,400	1,440,522,567,780
42	Jun-14	1,382	27,433,646	4,017,185,700	1,445,894,721,780
43	Jul-14	1,382	15,327,200	1,055,113,700	1,447,881,150,580
44	Aug-14	1,382	14,217,200	4,701,617,500	1,423,276,296,180
45	Sep-14	1,382	1,366,700	396,833,800	1,417,414,786,586
46	Oct-14	1,382	842,603,200	11,965,252,900	1,325,461,449,096
47	Nov-14	1,382	211,322,400	9,991,705,400	1,332,747,495,496
48	Dec-14	1,382	1,187,524,746	739,773,500	1,339,461,201,496
49	Jan-15	1,630	14,356,000	5,518,732,100	1,340,066,339,796
50	Feb-15	1,630	1,959,300	622,062,900	2,929,133,377,696
51	Mar-15	1,630	39,006,600	4,144,606,200	2,928,104,807,696
52	Apr-15	1,630	5,066,400	1,438,509,100	2,919,276,835,596
53	May-15	1,630	19,715,000	5,677,703,400	2,901,872,412,196
54	Jun-15	1,630	42,803,300	12,277,290,700	2,892,615,282,196

55	Jul-15	1,630	25,010,200	1,826,498,700	3,101,815,727,876
56	Aug-15	1,630	508,122,700	2,235,439,300	3,073,513,897,596
57	Sep-15	1,630	16,540,600	545,901,400	2,925,726,680,716
58	Oct-15	1,630	28,936,500	435,846,000	2,885,456,032,876
59	Nov-15	1,630	218,223,000	468,405,700	2,826,827,542,876
60	Dec-15	1,630	19,333,400	3,232,155,900	2,820,390,229,556
61	Jan-16	1,767	60,693,300	2,345,237,960	2,820,115,768,236
62	Feb-16	1,767	35,055,000	2,488,312,400	2,817,954,349,676
63	Mar-16	1,767	65,694,000	348,810,100	2,817,954,349,676
64	Apr-16	1,767	139,947,900	1,167,378,300	2,817,954,349,676
65	May-16	1,767	139,960,800	1,893,708,600	2,816,385,425,036
66	Jun-16	1,767	79,481,400	727,229,900	2,808,436,523,276
67	Jul-16	1,767	98,308,800	965,951,300	2,800,961,398,776
68	Aug-16	1,767	101,178,800	637,575,370	2,773,943,444,276
69	Sep-16	1,767	215,127,700	868,540,400	2,766,824,720,876
70	Oct-16	1,767	150,662,700	1,807,278,300	2,769,910,430,876

71	Nov-16	1,767	145,009,900	1,561,615,300	2,750,033,595,976
72	Dec-16	1,767	498,058,700	2,276,208,100	2,748,030,186,876
73	Jan-17	1,728	245,828,800	2,789,193,500	2,748,030,186,876
74	Feb-17	1,728	112,730,500	911,855,900	2,758,112,720,376
75	Mar-17	1,728	1,451,327,800	2,481,505,000	2,826,241,304,676
76	Apr-17	1,728	133,954,380	657,870,000	2,807,846,526,676
77	May-17	1,728	1,304,903,700	2,947,501,200	2,789,716,203,476
78	Jun-17	1,728	319,859,000	6,007,141,300	2,745,926,418,596
79	Jul-17	1,728	225,695,100	801,786,300	2,737,650,752,996
80	Aug-17	1,728	236,637,200	1,071,679,200	2,756,316,278,996
81	Sep-17	1,728	286,708,200	1,466,009,700	2,897,632,010,456
82	Oct-17	1,728	319,845,700	544,209,610	2,911,778,631,456
83	Nov-17	1,728	345,592,600	636,040,900	2,930,027,747,816
84	Dec-17	1,728	182,654,900	694,234,000	2,936,479,412,496

Table of (In) dependent Variables 1

In Rwanda, the Investment is published annually rather than monthly reason why the researcher preferred to use the annual Investment of the year as monthly data because they can give the same interpretation. ***Source: National Institute of Statistics of Rwanda, 3/13/2017***

CHAPTER IV: DATA ANALYSIS, RESULTS AND DISCUSSION / SOFTWARE DEVELOPMENT

4.1 Introduction

This chapter will contain analysis and model specification, we shall start testing data graphically to check if variables have intercept or trend and intercept. The following test will stationarity in order to understand if there is a consistence of the mean, variance and covariance. The next will be cointegration test in order to check the variables have the long term relationship. We shift to the Error Correction Model or Equilibrium Correction Mechanism; this last will assist in discovering the time which can be taken to adjust short run shocks which may occur. Finally, we will check on Vector Autoregressive Models (VAR) whereby, we check lag selection to be used while estimating; it will lead us test if our data are normally distributed and test of autocorrelation. The test of Homoskedasticity and Impulse-Response.

4.2 Model Specification

The model uses Investment as dependent variable and independent variables are share index, turnover and market capitalization.

The model is expressed as an implicit function and as follows:

$Y = f(X_1, X_2, X_3)$

Where;

Y = Investment

X_1 = share index

X_2 = turnover ratio

X_3 = market capitalization

The model is being expressed in estimation form will be $\mathbf{Y = ß_O + ß_1X_1 + ß_2X_2 + ß_3X_3 + \mu}$

Where =

$\mathbf{ß_O}$ = intercept

$\mathbf{ß_1}$ = coefficient of share index

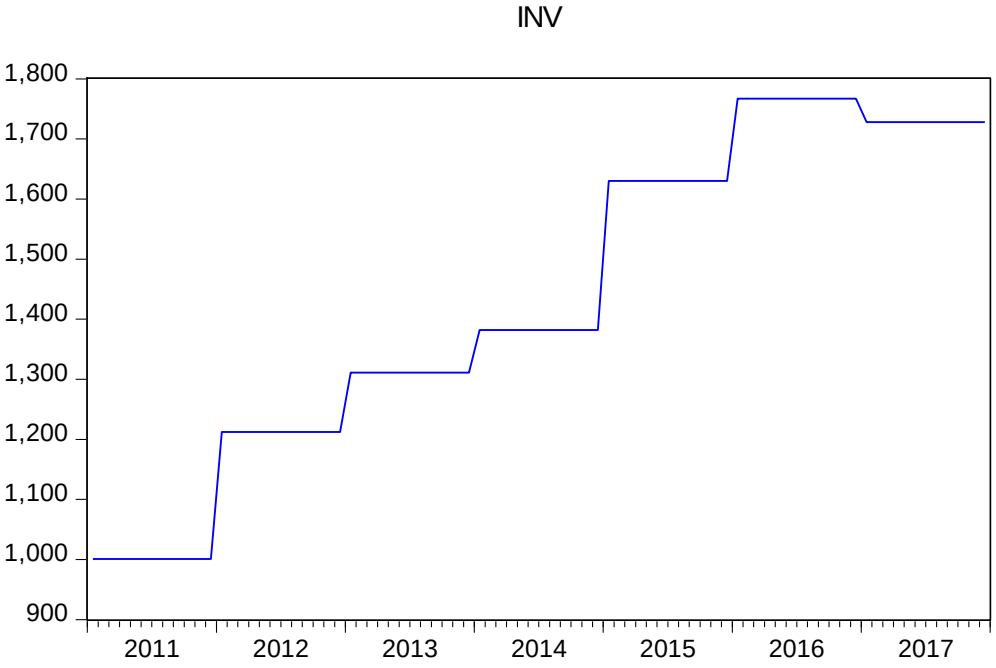
$\mathbf{ß_2}$= coefficient of turnover ratio

$\mathbf{ß_3}$ = coefficient of market capitalization

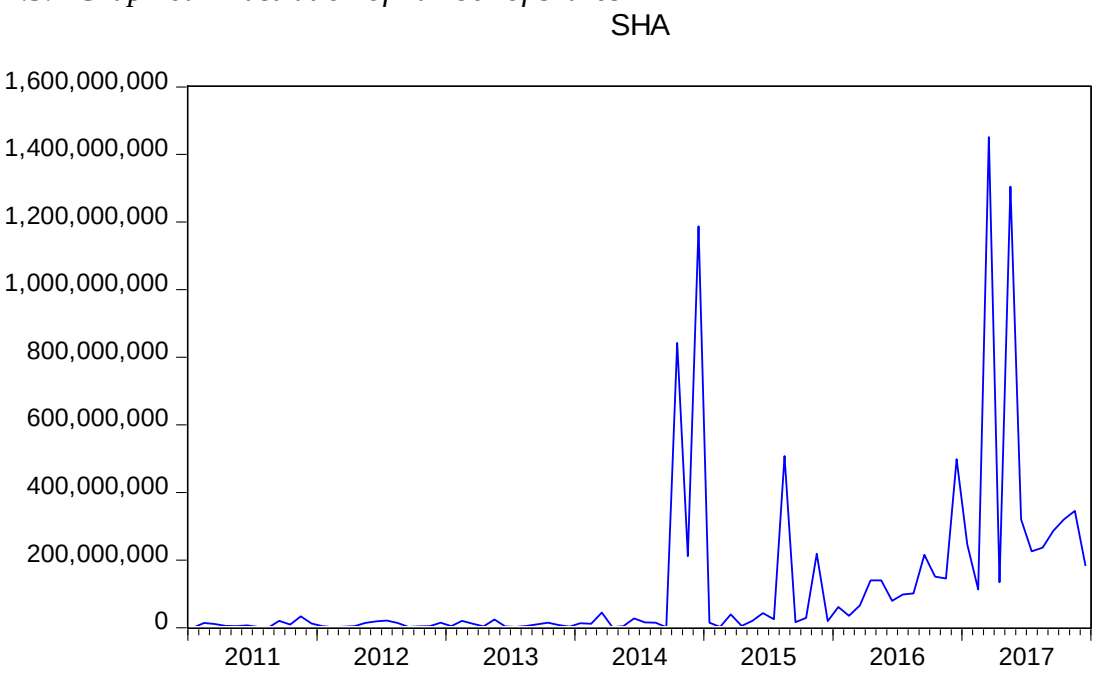
$\mathbf{\mu}$ = stochastic or error term

4.3 Graphical illustration of variables at the market

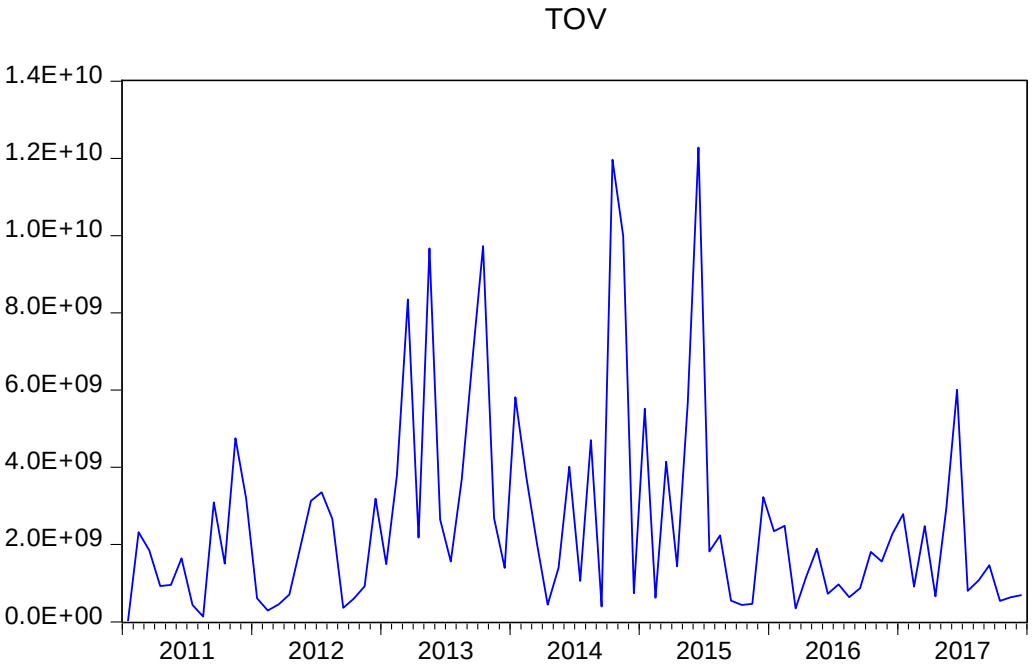
4.3.1 Graphical illustration of investment



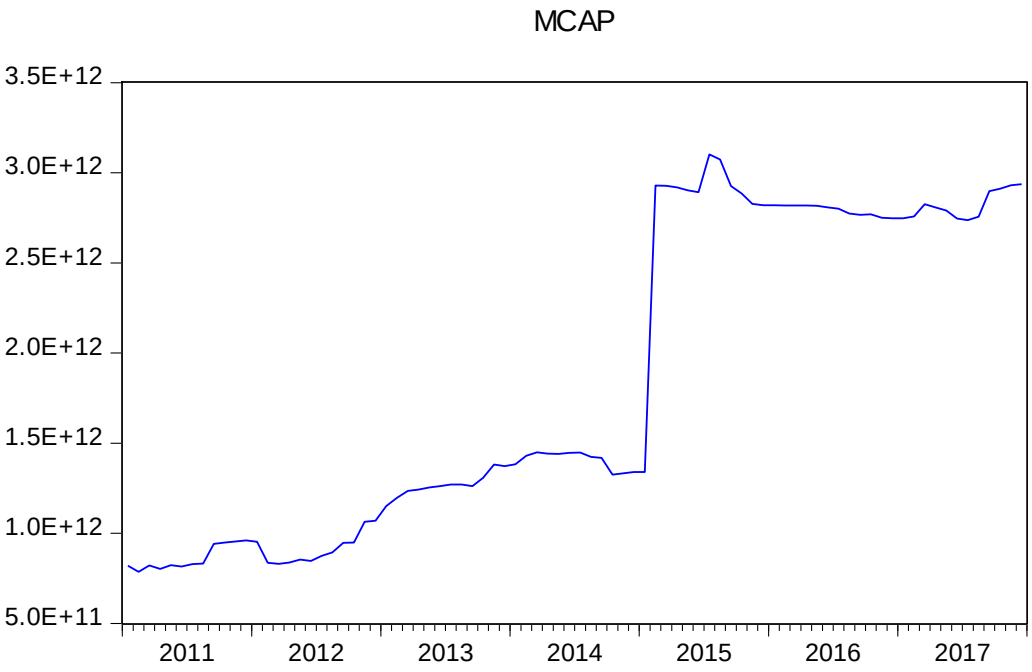
4.3.2 Graphical illustration of number of shares



4.3.3 Graphical illustration of turnover



4.3.1 Graphical illustration of market capitalization



4.4 Test of Stationarity using Augmented Dickey-Fuller Test

Broadly speaking, a stochastic process is said to be stationary if its mean and variance are constant over time and the value of the covariance between the two time periods depends only on the distance or gap or lag between the two time periods and not the actual time at which the covariance is computed.

4.4.1Test of Stationarity using Augmented Dickey-Fuller Test on Investment

4.4.1.1 Test of Stationarity using Augmented Dickey-Fuller Test on Investment at level

Null Hypothesis: INV has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.277694	0.4410
Test critical values:	1% level	-4.072415	
	5% level	-3.464865	
	10% level	-3.158974	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INV)
Method: Least Squares
Date: 09/19/18 Time: 21:20
Sample (adjusted): 2011M02 2017M12
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
INV(-1)	-0.144519	0.063450	-2.277694	0.0254
C	155.7624	62.93017	2.475163	0.0154
@TREND("2011M01")	1.418543	0.699841	2.026950	0.0460

R-squared	0.065741	Mean dependent var	8.759036
Adjusted R-squared	0.042385	S.D. dependent var	40.54344
S.E. of regression	39.67493	Akaike info criterion	10.23479
Sum squared resid	125928.0	Schwarz criterion	10.32222
Log likelihood	-421.7438	Hannan-Quinn criter.	10.26991
F-statistic	2.814688	Durbin-Watson stat	1.940231
Prob(F-statistic)	0.065870		

Investment is not stationary because ADF calculated |-2.277694| is lower than ADF critical value | -3.464865| at 5% of significance level, at level. And the p value is equal to 0.4410 which greater than 5%.

4.4.1.2 Test of Stationarity using Augmented Dickey-Fuller Test on Investment at first difference

Null Hypothesis: D(INV) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-9.382837	0.0000
Test critical values:	1% level	-4.073859	
	5% level	-3.465548	
	10% level	-3.159372	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(INV,2)
Method: Least Squares
Date: 09/19/18 Time: 21:22
Sample (adjusted): 2011M03 2017M12
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(INV(-1))	-1.053426	0.112272	-9.382837	0.0000
C	15.26530	9.459246	1.613797	0.1106
@TREND("2011M01")	-0.139430	0.192254	-0.725241	0.4704

R-squared	0.527072	Mean dependent var	0.000000
Adjusted R-squared	0.515099	S.D. dependent var	59.03692
S.E. of regression	41.11026	Akaike info criterion	10.30629
Sum squared resid	133514.2	Schwarz criterion	10.39434
Log likelihood	-419.5580	Hannan-Quinn criter.	10.34164
F-statistic	44.02222	Durbin-Watson stat	2.007566
Prob(F-statistic)	0.000000		

Investment is now stationary because ADF calculated |-9.382837| is greater than ADF critical |-3.465548| at 5% of significance level, at first difference and the p value is 0.0000 which less than 5%.

4.4.2 Test of Stationarity using Augmented Dickey-Fuller Test on volumes (number of shares) traded

4.4.2.1 Test of Stationary using Augmented Dickey-Fuller Test on volumes (number of shares) traded at level

Null Hypothesis: SHA has a unit root
Exogenous: Constant
Lag Length: 1 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-3.334524	0.0164
Test critical values:	1% level	-3.512290	
	5% level	-2.897223	
	10% level	-2.585861	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(SHA)
Method: Least Squares
Date: 09/19/18 Time: 21:24
Sample (adjusted): 2011M03 2017M12
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SHA(-1)	-0.422874	0.126817	-3.334524	0.0013
D(SHA(-1))	-0.500015	0.097705	-5.117608	0.0000
C	57578537	30436227	1.891776	0.0622

R-squared	0.566767	Mean dependent var	2062612.
Adjusted R-squared	0.555799	S.D. dependent var	3.54E+08
S.E. of regression	2.36E+08	Akaike info criterion	41.43102
Sum squared resid	4.39E+18	Schwarz criterion	41.51907
Log likelihood	-1695.672	Hannan-Quinn criter.	41.46637
F-statistic	51.67496	Durbin-Watson stat	2.123276
Prob(F-statistic)	0.000000		

Volume (Number of Shares) traded is stationary because ADF calculated |-3.334524| is greater than ADF critical |-2.897223 | at 5% of significance level, at level and the p value is 0.0164 which less than 5%.

4.4.3 Test of Stationary using Augmented Dickey-Fuller Test on Turnover (Rwandan francs)

4.4.3.1 Test of Stationary using Augmented Dickey-Fuller Test on Turnover (Rwandan francs) at level

Null Hypothesis: TOV has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-7.182729	0.0000
Test critical values:	1% level	-4.072415	
	5% level	-3.464865	
	10% level	-3.158974	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(TOV)
Method: Least Squares
Date: 09/19/18 Time: 21:26
Sample (adjusted): 2011M02 2017M12
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TOV(-1)	-0.780144	0.108614	-7.182729	0.0000
C	2.26E+09	6.52E+08	3.475756	0.0008
@TREND("2011M01")	-5589829.	12057823	-0.463585	0.6442

R-squared	0.392545	Mean dependent var	8334494.
Adjusted R-squared	0.377359	S.D. dependent var	3.33E+09
S.E. of regression	2.63E+09	Akaike info criterion	46.25490
Sum squared resid	5.54E+20	Schwarz criterion	46.34232
Log likelihood	-1916.578	Hannan-Quinn criter.	46.29002
F-statistic	25.84854	Durbin-Watson stat	2.031537
Prob(F-statistic)	0.000000		

Turnover is stationary because ADF calculated |-7.182729 | is greater than ADF critical |-3.464865| at 5% of significance level, at level and the p value is 0.0000 which less than 5%.

4.4.4 Test of Stationary using Augmented Dickey-Fuller Test on market capitalization in Rwandan francs (end of period)

4.4.4.1 Test of Stationary using Augmented Dickey-Fuller Test on market capitalization in Rwandan francs (end of period) at level

Null Hypothesis: MCAP has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-2.353797	0.4007
Test critical values:	1% level	-4.072415	
	5% level	-3.464865	
	10% level	-3.158974	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MCAP)
Method: Least Squares
Date: 09/19/18 Time: 21:27
Sample (adjusted): 2011M02 2017M12
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
MCAP(-1)	-0.126979	0.053946	-2.353797	0.0210
C	7.74E+10	4.55E+10	1.703394	0.0924
@TREND("2011M01")	4.28E+09	1.96E+09	2.182688	0.0320

R-squared	0.064860	Mean dependent var	2.55E+10
Adjusted R-squared	0.041481	S.D. dependent var	1.80E+11
S.E. of regression	1.76E+11	Akaike info criterion	54.66069
Sum squared resid	2.48E+24	Schwarz criterion	54.74811
Log likelihood	-2265.418	Hannan-Quinn criter.	54.69581
F-statistic	2.774328	Durbin-Watson stat	1.905078
Prob(F-statistic)	0.068402		

Market Capitalization in Rwandan Francs (end of period) is not stationary because ADF calculated -2.353797| is lower than ADF critical |-3.464865| at 5% of significance level, at level and the p value is 0.4007 which is greater than 5%.

4.4.4.2 Test of Stationary using Augmented Dickey-Fuller Test on market capitalization in Rwandan francs (end of period) at first difference

Null Hypothesis: D(MCAP) has a unit root
Exogenous: Constant, Linear Trend
Lag Length: 0 (Automatic - based on SIC, maxlag=11)

		t-Statistic	Prob.*
Augmented Dickey-Fuller test statistic		-8.999653	0.0000
Test critical values:	1% level	-4.073859	
	5% level	-3.465548	
	10% level	-3.159372	

*MacKinnon (1996) one-sided p-values.

Augmented Dickey-Fuller Test Equation
Dependent Variable: D(MCAP,2)
Method: Least Squares
Date: 09/19/18 Time: 21:27
Sample (adjusted): 2011M03 2017M12
Included observations: 82 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MCAP(-1))	-1.011938	0.112442	-8.999653	0.0000
C	2.55E+10	4.16E+10	0.613043	0.5416
@TREND("2011M01")	24042482	8.54E+08	0.028158	0.9776

R-squared	0.506252	Mean dependent var	4.86E+08
Adjusted R-squared	0.493752	S.D. dependent var	2.57E+11
S.E. of regression	1.83E+11	Akaike info criterion	54.73927
Sum squared resid	2.65E+24	Schwarz criterion	54.82732
Log likelihood	-2241.310	Hannan-Quinn criter.	54.77462
F-statistic	40.50028	Durbin-Watson stat	1.999906
Prob(F-statistic)	0.000000		

Market Capitalization in Rwandan Francs (end of period) is now stationary because ADF calculated |-8.999653 | is greater than ADF critical |-3.465548 | at 5% of significance level, at first difference and the p value is 0.0000 which is less than 5%.

4.5 Cointegration Test

4.5.1 d(inv) and sha

Dependent Variable: D(INV)
Method: Fully Modified Least Squares (FMOLS)
Date: 09/19/18 Time: 21:29
Sample (adjusted): 2011M02 2017M12
Included observations: 83 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SHA	-1.27E-08	1.50E-08	-0.848730	0.3985
C	10.48274	4.448619	2.356403	0.0209

R-squared	0.009360	Mean dependent var	8.759036
Adjusted R-squared	-0.002870	S.D. dependent var	40.54344
S.E. of regression	40.60158	Sum squared resid	133527.5
Long-run variance	1343.306		

Cointegration Test - Engle-Granger
Date: 09/19/18 Time: 21:30
Equation: UNTITLED
Specification: D(INV) SHA C
Cointegrating equation deterministics: C
Null hypothesis: Series are not cointegrated
Automatic lag specification (lag=0 based on Schwarz Info Criterion, maxlag=11)

	Value	Prob.*
Engle-Granger tau-statistic	-9.329394	0.0000
Engle-Granger z-statistic	-84.93230	0.0000

*MacKinnon (1996) p-values.

Investment and number of shares are cointegrated, because the p- value of Engle-Granger tau-statistic and z-statistic are 0.0000.

4.5.2 d(inv) and tov

Dependent Variable: D(INV)
Method: Fully Modified Least Squares (FMOLS)
Date: 09/19/18 Time: 21:31
Sample (adjusted): 2011M02 2017M12
Included observations: 83 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TOV	9.37E-10	1.52E-09	0.614936	0.5403
C	6.356598	5.658510	1.123369	0.2646

R-squared	0.001494	Mean dependent var	8.759036
Adjusted R-squared	-0.010833	S.D. dependent var	40.54344
S.E. of regression	40.76246	Sum squared resid	134587.8
Long-run variance	1355.448		

Cointegration Test - Engle-Granger
Date: 09/19/18 Time: 21:32
Equation: UNTITLED
Specification: D(INV) TOV C
Cointegrating equation deterministics: C
Null hypothesis: Series are not cointegrated
Automatic lag specification (lag=0 based on Schwarz Info Criterion, maxlag=11)

	Value	Prob.*
Engle-Granger tau-statistic	-9.392643	0.0000
Engle-Granger z-statistic	-85.49423	0.0000

*MacKinnon (1996) p-values.

Investment and number of Turnover are cointegrated, because the p- value of Engle-Granger tau-statistic and z-statistic are 0.0000.

4.5.3 d(inv) and d(mcap)

Dependent Variable: D(INV)
Method: Fully Modified Least Squares (FMOLS)
Date: 09/19/18 Time: 21:33
Sample (adjusted): 2011M03 2017M12
Included observations: 82 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
D(MCAP)	7.29E-12	2.28E-11	0.319571	0.7501
C	8.641165	4.139842	2.087318	0.0400

R-squared	-0.002340	Mean dependent var	8.865854
Adjusted R-squared	-0.014869	S.D. dependent var	40.78119
S.E. of regression	41.08326	Sum squared resid	135026.7
Long-run variance	1376.021		

Cointegration Test - Engle-Granger
Date: 09/19/18 Time: 21:34
Equation: UNTITLED
Specification: D(INV) D(MCAP) C
Cointegrating equation deterministics: C
Null hypothesis: Series are not cointegrated
Automatic lag specification (lag=0 based on Schwarz Info Criterion, maxlag=11)

	Value	Prob.*
Engle-Granger tau-statistic	-9.338524	0.0000
Engle-Granger z-statistic	-85.02543	0.0000

*MacKinnon (1996) p-values.

Investment and number of market capitalization are cointegrated, because the p- value of Engle-Granger tau-statistic and z-statistic are 0.0000.

4.5.4 d(inv) sha tov and d(mcap)

Dependent Variable: D(INV)
Method: Fully Modified Least Squares (FMOLS)
Date: 09/19/18 Time: 21:35
Sample (adjusted): 2011M03 2017M12
Included observations: 82 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SHA	-1.49E-08	1.49E-08	-0.998952	0.3209
TOV	1.13E-09	1.51E-09	0.749575	0.4558
D(MCAP)	3.64E-12	2.24E-11	0.162238	0.8715
C	7.761583	5.927089	1.309510	0.1942

R-squared	0.010667	Mean dependent var	8.865854
Adjusted R-squared	-0.027384	S.D. dependent var	40.78119
S.E. of regression	41.33580	Sum squared resid	133274.6
Long-run variance	1317.545		

Cointegration Test - Engle-Granger
Date: 09/19/18 Time: 21:36
Equation: UNTITLED
Specification: D(INV) SHA TOV D(MCAP) C
Cointegrating equation deterministics: C
Null hypothesis: Series are not cointegrated
Automatic lag specification (lag=0 based on Schwarz Info Criterion, maxlag=11)

	Value	Prob.*
Engle-Granger tau-statistic	-9.163172	0.0000
Engle-Granger z-statistic	-83.45220	0.0000

*MacKinnon (1996) p-values.

Investment, number of shares, turnover and market capitalization are cointegrated, because the p-value of Engle-Granger tau-statistic and z-statistic are 0.0000.

4.5.5 d(inv) tov and d(mcap)

Dependent Variable: D(INV)
Method: Fully Modified Least Squares (FMOLS)
Date: 09/19/18 Time: 21:37
Sample (adjusted): 2011M03 2017M12
Included observations: 82 after adjustments
Cointegrating equation deterministics: C
Long-run covariance estimate (Bartlett kernel, Newey-West fixed bandwidth = 4.0000)

Variable	Coefficient	Std. Error	t-Statistic	Prob.
TOV	1.00E-09	1.53E-09	0.653138	0.5156
D(MCAP)	7.73E-12	2.28E-11	0.339331	0.7353
C	5.985020	5.773601	1.036618	0.3031

R-squared	-0.000875	Mean dependent var	8.865854
Adjusted R-squared	-0.026214	S.D. dependent var	40.78119
S.E. of regression	41.31225	Sum squared resid	134829.4
Long-run variance	1362.907		

Cointegration Test - Engle-Granger
Date: 09/19/18 Time: 21:38
Equation: UNTITLED
Specification: D(INV) TOV D(MCAP) C
Cointegrating equation deterministics: C
Null hypothesis: Series are not cointegrated
Automatic lag specification (lag=0 based on Schwarz Info Criterion, maxlag=11)

	Value	Prob.*
Engle-Granger tau-statistic	-9.312514	0.0000
Engle-Granger z-statistic	-84.79209	0.0000

*MacKinnon (1996) p-values.

Investment, turnover and market capitalization are cointegrated, because the p- value of Engle-Granger tau-statistic and z-statistic are 0.0000.

4.6 Error Correction Model

Dependent Variable: D(INV)
Method: Least Squares
Date: 09/19/18 Time: 21:40
Sample (adjusted): 2011M02 2017M12
Included observations: 83 after adjustments

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SHA	-1.33E-08	1.71E-08	-0.775204	0.4406
TOV	8.00E-10	1.72E-09	0.465747	0.6427
D(MCAP)	2.89E-12	2.77E-11	0.104513	0.9170
E(-1)	-0.038039	0.053819	-0.706800	0.4818
C	8.295169	6.749864	1.228939	0.2228

R-squared	0.018727	Mean dependent var	8.759036
Adjusted R-squared	-0.031595	S.D. dependent var	40.54344
S.E. of regression	41.17895	Akaike info criterion	10.33208
Sum squared resid	132265.0	Schwarz criterion	10.47779
Log likelihood	-423.7814	Hannan-Quinn criter.	10.39062
F-statistic	0.372137	Durbin-Watson stat	2.021168
Prob(F-statistic)	0.827832		

D(INV)= 8.295169-1.33E-08 SHA + 8.00E-10 TOV + 2.89E-12 D(MCAP) -0.038039 E(-1) + U

The errors will be corrected in 33 months.

4.7 Econometric model related to the economic model

4.7.1 Econometric model related to the economic model using E-Views

Dependent Variable: INV
Method: Least Squares
Date: 09/19/18 Time: 21:42
Sample: 2011M01 2017M12
Included observations: 84

Variable	Coefficient	Std. Error	t-Statistic	Prob.
SHA	4.80E-08	4.03E-08	1.190221	0.2375
TOV	4.58E-09	3.87E-09	1.182313	0.2406
MCAP	2.81E-10	1.24E-11	22.64141	0.0000
C	899.9728	26.77694	33.61000	0.0000

R-squared	0.882071	Mean dependent var	1433.000
Adjusted R-squared	0.877649	S.D. dependent var	266.2565
S.E. of regression	93.13308	Akaike info criterion	11.95238
Sum squared resid	693901.6	Schwarz criterion	12.06814
Log likelihood	-498.0001	Hannan-Quinn criter.	11.99892
F-statistic	199.4588	Durbin-Watson stat	0.559949
Prob(F-statistic)	0.000000		

INV=899.9728 + 4.80E-08**SHA** + 4.58E-09**TOV** + 2.81E-10**MCAP** + U

SE	26.77694	4.03E-08	3.87E-09	1.24E-11
T-test	33.61000	1.190221	1.182313	22.64141
Prob	0.0000	0.2375	0.2406	0.0000

The probability of MCAP shows how much, it is significant and it affects the investment and R^2 is equal to 0.88 which values 88%.

4.7.2 Econometric model related to the economic model using Stata

```
. do "C:\Users\CHRIST~1\AppData\Local\Temp\STD00000000.tmp"

. reg INV SHA TOV MCAP
```

Source	SS	df	MS		
Model	5190178.4	3	1730059.47	Number of obs	= 84
Residual	693901.599	80	8673.76998	F(3, 80)	= 199.46
				Prob > F	= 0.0000
Total	5884080	83	70892.5301	R-squared	= 0.8821
				Adj R-squared	= 0.8776
				Root MSE	= 93.133

INV	Coef.	Std. Err.	t	P>|t|	[95% Conf.	Interval]
SHA	4.80e-08	4.03e-08	1.19	0.237	-3.22e-08	1.28e-07
TOV	4.58e-09	3.87e-09	1.18	0.241	-3.13e-09	1.23e-08
MCAP	2.81e-10	1.24e-11	22.64	0.000	2.56e-10	3.05e-10
_cons	899.9728	26.77694	33.61	0.000	846.685	953.2606

```
.
end of do-file
```

The model is significant at 88%. The other interpretation are the same as the ones from E-views above.

4.8 VAR and Impulse-Response Functions

4.8.1 Vector Autoregression Estimates

Vector Autoregression Estimates
Date: 09/23/18 Time: 16:43
Sample (adjusted): 2011M03 2017M12
Included observations: 82 after adjustments
Standard errors in ( ) & t-statistics in [ ]

	INV	SHA	TOV	MCAP
INV(-1)	0.946067	-1109886.	-1710918.	2.28E+09
	(0.11356)	(653831.)	(7630075)	(3.8E+08)
	[8.33126]	[-1.69751]	[-0.22423]	[6.00563]
INV(-2)	-0.018637	1316455.	4996643.	-1.97E+09
	(0.11854)	(682535.)	(7965041)	(4.0E+08)
	[-0.15722]	[1.92877]	[0.62732]	[-4.95984]
SHA(-1)	4.53E-08	0.002801	1.057667	-54.10933
	(1.7E-08)	(0.10016)	(1.16885)	(58.1566)
	[2.60265]	[0.02797]	[0.90488]	[-0.93041]
SHA(-2)	6.14E-09	0.470823	-2.148876	213.5146
	(1.8E-08)	(0.10506)	(1.22606)	(61.0030)
	[0.33650]	[4.48134]	[-1.75266]	[3.50007]
TOV(-1)	-1.78E-09	-0.009135	0.206599	10.74082
	(1.7E-09)	(0.00988)	(0.11530)	(5.73662)
	[-1.03582]	[-0.92463]	[1.79189]	[1.87233]
TOV(-2)	3.69E-09	0.021128	0.078500	-10.17578
	(1.7E-09)	(0.00995)	(0.11606)	(5.77476)
	[2.13335]	[2.12438]	[0.67635]	[-1.76211]
MCAP(-1)	-3.91E-12	-7.71E-05	-0.000241	0.986386
	(2.8E-11)	(0.00016)	(0.00185)	(0.09227)
	[-0.14158]	[-0.48489]	[-0.12993]	[10.6899]
MCAP(-2)	1.45E-11	7.21E-05	-0.000866	-0.100400
	(2.6E-11)	(0.00015)	(0.00172)	(0.08553)
	[0.56611]	[0.48943]	[-0.50355]	[-1.17382]
C	82.33278	-2.34E+08	-6.76E+08	-2.56E+11
	(49.2811)	(2.8E+08)	(3.3E+09)	(1.6E+11)
	[1.67068]	[-0.82642]	[-0.20413]	[-1.55576]
R-squared	0.979430	0.374021	0.125055	0.979553
Adj. R-squared	0.977175	0.305421	0.029170	0.977312
Sum sq. resids	113172.2	3.75E+18	5.11E+20	1.26E+24
S.E. equation	39.37389	2.27E+08	2.65E+09	1.32E+11
F-statistic	434.4759	5.452171	1.304224	437.1548
Log likelihood	-412.7808	-1689.198	-1890.672	-2211.055
Akaike AIC	10.28734	41.41946	46.33346	54.14769
Schwarz SC	10.55149	41.68361	46.59762	54.41185
Mean dependent	1443.537	1.28E+08	2.60E+09	1.86E+12

S.D. dependent	260.6196	2.72E+08	2.69E+09	8.74E+11

Determinant resid covariance (dof adj.)	8.55E+60
Determinant resid covariance	5.37E+60
Log likelihood	-6198.687
Akaike information criterion	152.0655
Schwarz criterion	153.1221
Number of coefficients	36

4.8.2 Lag Selection

VAR Lag Order Selection Criteria
Endogenous variables: INV SHA TOV MCAP
Exogenous variables: C
Date: 09/23/18 Time: 16:53
Sample: 2011M01 2017M12
Included observations: 80

Lag	LogL	LR	FPE	AIC	SC	HQ
0	-6296.577	NA	3.00e+63	157.5144	157.6335	157.5622
1	-6092.224	383.1618	2.71e+61	152.8056	153.4011	153.0444
2	-6050.801	73.52659*	1.44e+61*	152.1700*	153.2419*	152.5998*
3	-6043.136	12.83841	1.79e+61	152.3784	153.9267	152.9992
4	-6034.853	13.04613	2.20e+61	152.5713	154.5960	153.3831

* indicates lag order selected by the criterion
LR: sequential modified LR test statistic (each test at 5% level)
FPE: Final prediction error
AIC: Akaike information criterion
SC: Schwarz information criterion
HQ: Hannan-Quinn information criterion

The above results show that the minimum lag selection is lag 2 in order to continue with further testing.

4.8.3 Test of Normal Distribution

VAR Residual Normality Tests
Orthogonalization: Cholesky (Lutkepohl)
Null Hypothesis: Residuals are multivariate normal
Date: 09/23/18 Time: 16:57
Sample: 2011M01 2017M12
Included observations: 82

Component	Skewness	Chi-sq	df	Prob.*
1	3.183077	138.4704	1	0.0000
2	2.548848	88.78719	1	0.0000
3	1.622865	35.99377	1	0.0000
4	0.833140	9.486342	1	0.0021
Joint		272.7377	4	0.0000

Component	Kurtosis	Chi-sq	df	Prob.
1	14.45090	448.0041	1	0.0000
2	14.81818	477.2037	1	0.0000
3	6.012654	31.00996	1	0.0000
4	15.30319	517.1754	1	0.0000
Joint		1473.393	4	0.0000

Component	Jarque-Bera	df	Prob.
1	586.4745	2	0.0000
2	565.9908	2	0.0000
3	67.00372	2	0.0000
4	526.6617	2	0.0000
Joint	1746.131	8	0.0000

*Approximate p-values do not account for coefficient Estimation

Basing of the above results, the variables are normally distributed the p value is 0.0000

4.8.4 Test of Autocorrelation

VAR Residual Serial Correlation LM Tests
Date: 09/23/18 Time: 17:00
Sample: 2011M01 2017M12
Included observations: 82

Null hypothesis: No serial correlation at lag h

Lag	LRE* stat	df	Prob.	Rao F-stat	Df	Prob.
1	13.21261	16	0.6572	0.823902	(16, 202.3)	0.6576
2	17.85963	16	0.3322	1.126265	(16, 202.3)	0.3327

Null hypothesis: No serial correlation at lags 1 to h

Lag	LRE* stat	df	Prob.	Rao F-stat	df	Prob.
1	13.21261	16	0.6572	0.823902	(16, 202.3)	0.6576
2	25.21818	32	0.7971	0.779245	(32, 230.2)	0.7984

*Edgeworth expansion corrected likelihood ratio statistic.

At lag 2, the autocorrelation is at 33% which is fair for analysis.

4.8.5 Test of Homoskedasticity

The results below show that the mean and variances are not varying over time.

VAR Residual Heteroskedasticity Tests (Levels and Squares)
Date: 09/23/18 Time: 16:58
Sample: 2011M01 2017M12
Included observations: 82

Joint test:

Chi-sq	df	Prob.
257.8367	160	0.0000

Individual components:

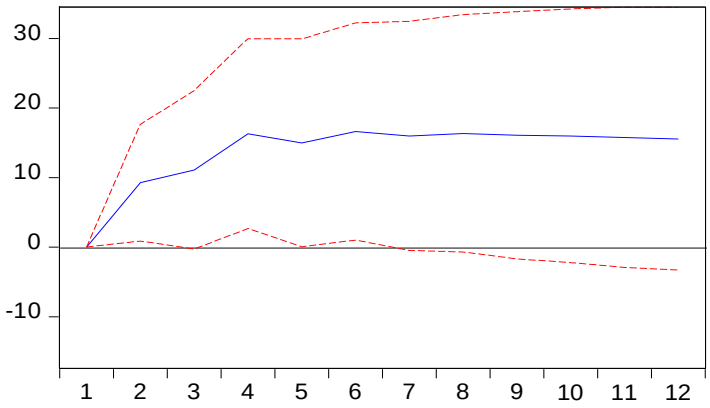
Dependent	R-squared	F(16,65)	Prob.	Chi-sq(16)	Prob.
res1*res1	0.240056	1.283287	0.2349	19.68457	0.2348
res2*res2	0.181068	0.898230	0.5742	14.84759	0.5358
res3*res3	0.169904	0.831512	0.6463	13.93213	0.6038
res4*res4	0.886306	31.66927	0.0000	72.67706	0.0000
res2*res1	0.405861	2.775131	0.0019	33.28064	0.0068
res3*res1	0.177162	0.874680	0.5995	14.52728	0.5595
res3*res2	0.197522	0.999947	0.4682	16.19684	0.4393
res4*res1	0.516404	4.338101	0.0000	42.34510	0.0004
res4*res2	0.499649	4.056795	0.0000	40.97119	0.0006
res4*res3	0.405216	2.767714	0.0020	33.22774	0.0069

4.8.6 Impulse-Response of variables of the model

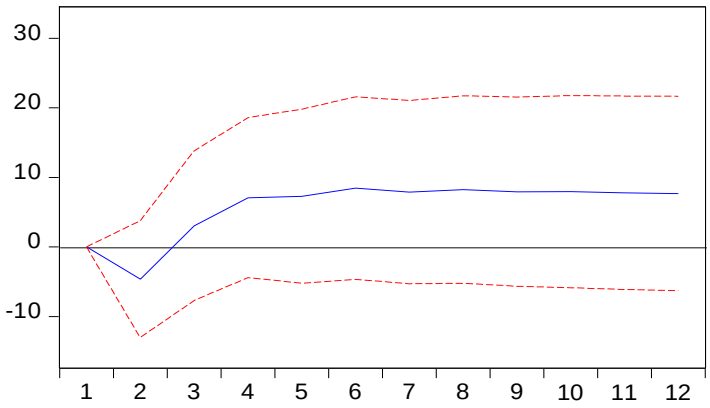
4.8.6.1 Response of Investment

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

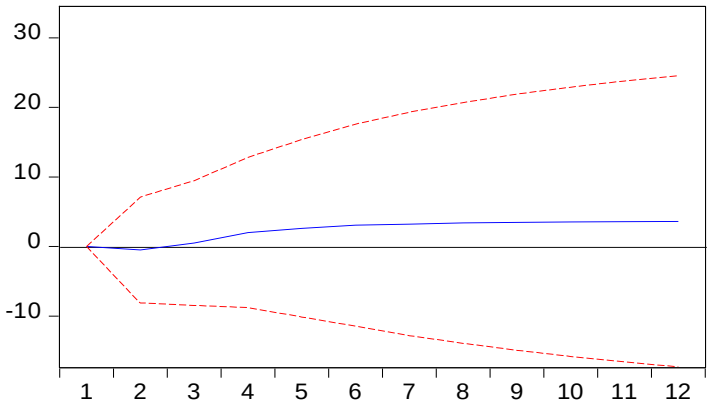
Response of INV to SHA



Response of INV to TOV



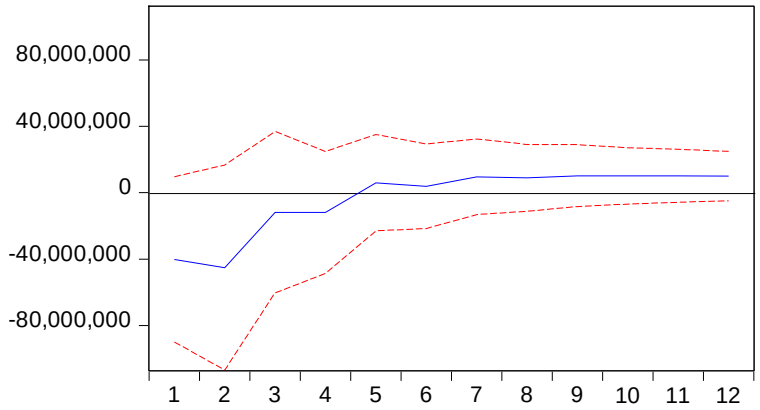
Response of INV to MCAP



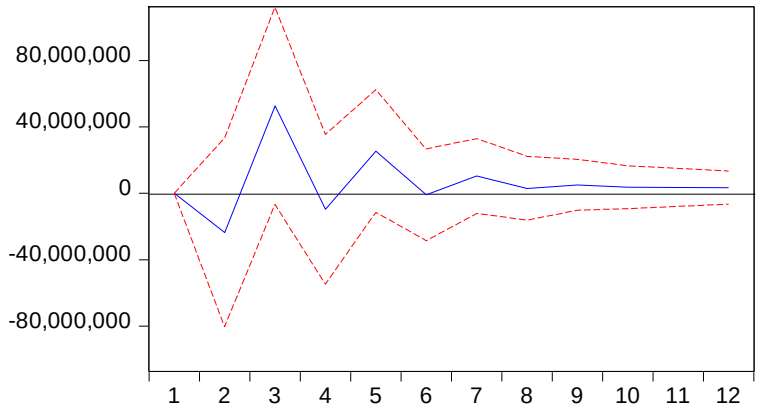
4.8.6.2 Response of number of shares

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

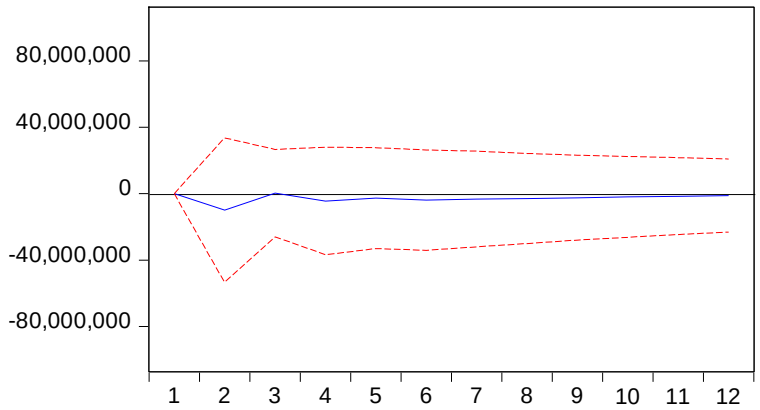
Response of SHA to INV



Response of SHA to TOV



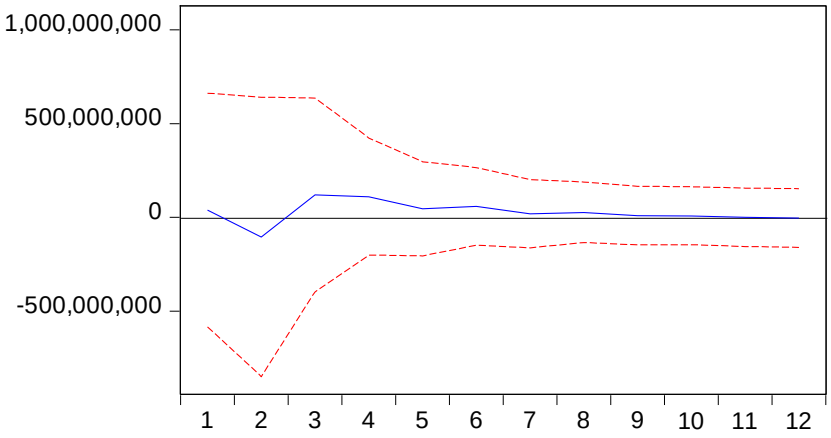
Response of SHA to MCAP



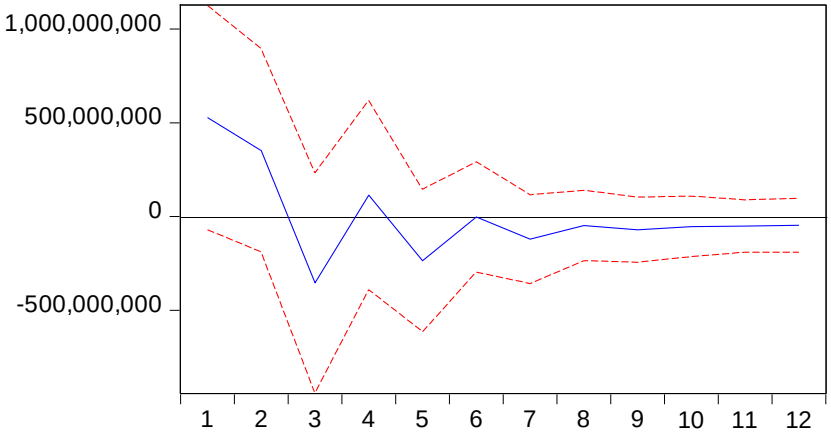
4.8.6.3 Response of Turnover

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

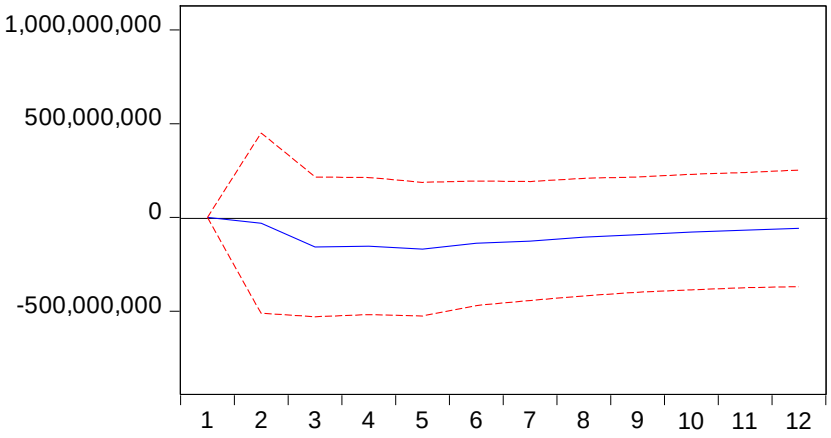
Response of TOV to INV



Response of TOV to SHA



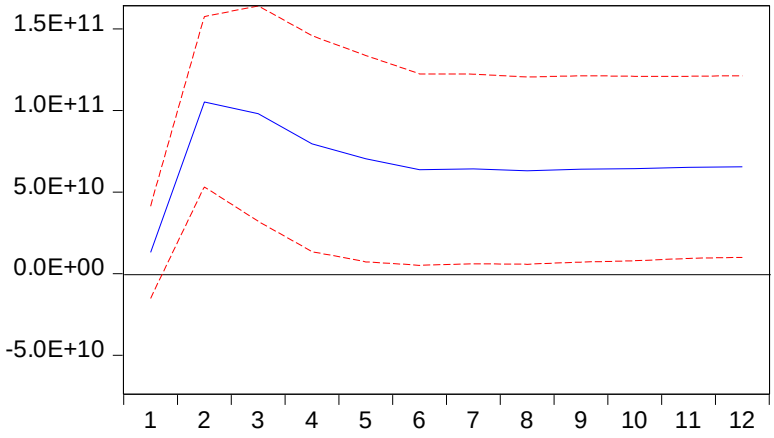
Response of TOV to MCAP



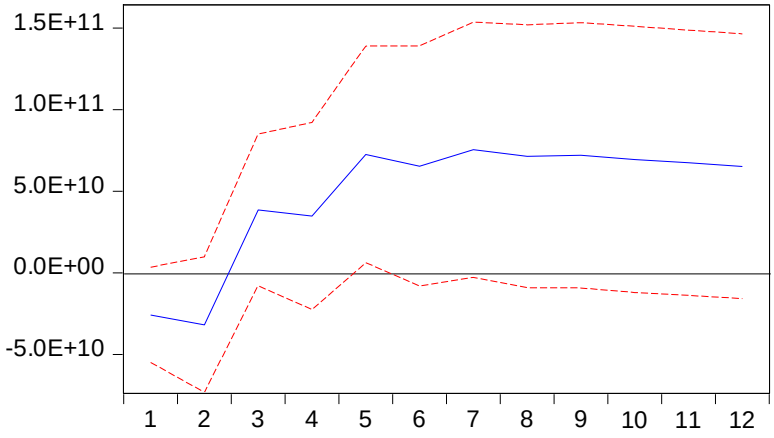
4.8.6.4 Response of market capitalization

Response to Cholesky One S.D. (d.f. adjusted) Innovations ± 2 S.E.

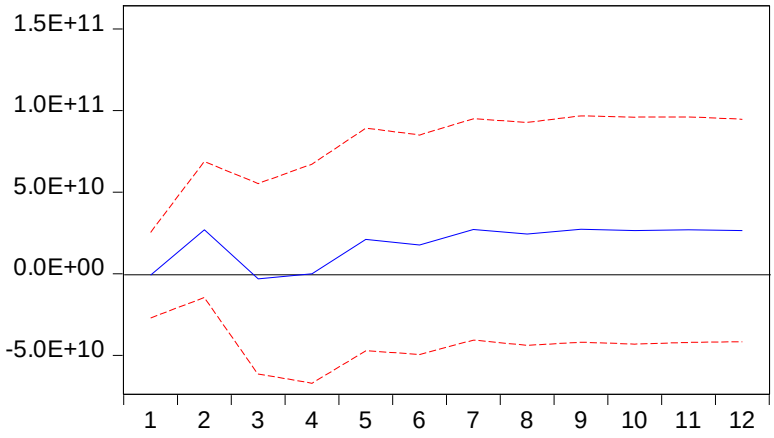
Response of MCAP to INV



Response of MCAP to SHA



Response of MCAP to TOV



4.8.7 Impulse-Response Interpretations

4.8.7.1 Impulse-Response Interpretations on investment

- When there is a shock in number of shares, it will raise the investment the first, second and third month, from the forth one it will be stable.
- When there is a shock in turnover, it will raise the investment the first, second and third month, from the forth one it will be stable.
- When there is a shock in market capitalization, investment will not change the first three months, from the forth one it will raise a little and becomes stable.

4.8.7.2 Impulse-Response Interpretations on number of shares

- When there is a shock in investment, there will be no change number of shares for the first month, but, the second month it will be negative, it raises in the third month and from the forth becomes stable.
- When there is a shock in the number of shares, the turnover will decreases no impact in the first month, but in the second month they will be in negative, in third month becomes positive, forth month decline again up and have a small negative, from the fifth and the sixth, there will be a small change, and becomes constant.
- When there is a shock in market capitalization, number of shares will not change the first month, but in the second month they will become negative, furthermore, from the third one they will become stable.

4.8.7.3 Impulse-Response Interpretations on turnover

- When there is a shock in investment, it will affect negatively turnover, but, it will raise from the second month, the third one becomes stable, and the forth one starts to decrease up to the fifth and from the sixth month one it will be stable above the axis.
- A shock in number of shares will definitely lower the turnover from the first month up to the third month. Moreover there will a trend until the seventh month, further, they become stable near and below the axis.
- A shock in market capitalization will impact negatively the turnover in second month whereby and it will raise smoothly, but, again below the axis.

4.8.7.4 Impulse-Response Interpretations on market capitalization

- A shock in investment will push market capitalization to raise immediately in the first month and start to decline in the four months, in addition, from the sixth month, it the market capitalization will become steady.
- For number of shares, they will not for the first month, the raise will occur in the second one, become stable in the third one, raise again in the forth and again up to the seventh month whereby, the stability will start.
- Lastly, the shock in turnover will raise the market capitalization for the first month and instantly the second one drops, the third month, there will be a short stability and there will be a smooth increase up to the seventh month whereby, the stability will start.

CHAPTER V: SUMMARY, CONCLUSION AND RECOMMENDATIONS

5.1 Summary and Conclusion

This research was focusing on the lower level of investment in Rwanda; among the causes of this economy are the geographical situation of country, effects of the history the country caused by the 1994 Genocide against Tutsi, ineffectiveness and inefficiency of local governance which led to the lag in investment.

Thus, the investment should be promoted through different determinants such education, developing infrastructures etc. The researcher had an intuition to find another response of investment sustainability in Rwanda through the capital markets.

The econometric model has been developed to analyse the impact of capital markets on investment. The predictor variables used in regression were number of shares, turnover and market capitalization and predicted variable was investment. The data of trading statistics used the research were since 2011 to 2017. Moreover, the number of variables 84, due to the monthly frequency.

As result, the variables were jointly cointegrated which means that, they have long run relationship. In addition, the unit root test has been computed in order to get stationarity of all variables in the model with respective levels; investment and market capitalisation were stationary at first difference, whereas, number of shares and turnover were stationary at level. Besides, in the regression model, the market capitalization was significant among other independent variables. The coefficient of determination is highly fitting the regression due to the 88% of R^2. In short run, the Error Correction Model, the results show that the errors will be corrected in 33 months.

Lastly, in the estimate of the vector autoregressive (VAR) model, the researcher was interested in impulse-response analysis, where a certain variable would respond to the shock of another variable. The researcher has firstly select the number of lags; secondly by normal distribution test; thirdly by autocorrelation and fourthly homoscedasticity.

5.2 Recommendations

This research has been focusing on economic modelling of capital market and investment sustainability. Due to the challenges facing the investment like inflation due to the global oil prices and ineffective awareness of the capital market; the researcher proposes some below recommendations:

- Participation of Government in capital markets in order to assure the private sector also to invest and save more for the future which will lead to the sustainable investment.
- Sensitization in non-financials businesses like individuals, small enterprises and corporates and financials to invest in capital markets that help in future.
- An adequate reporting system of trading of stock exchanges which guarantee the stakeholders.

BIBLIOGRAPHY AND REFERENCES

- 'Investment for Sustainable Development', 2015, 1–12.
- An Aviva and White Paper, 'A Roadmap for Sustainable Capital Markets
- Basic Econometrics, As in the Previous Three Editions, the Primary Objective of the Fourth Edition Of, 2004.
- http://rdb.rw/rwanda-development-board-registers-usd-1-675-billion-worth-of-investments-in-2017/
- https://open.lib.umn.edu/principleseconomics/.../29-2-determinants-of-investment/
- Introductory Econometrics for Finance SECOND EDITION Chris Brooks The ICMA Centre, University of Reading .
- Investment Policy Framework and F O R Sustainable Development, 'INVESTMENT POLICY FRAMEWORK', 2015.
- Junanker, P.N. (1972) Investment: Theoriesand Evidence, London: Macmillan
- Masafumi Yabara, 'Capital Market Integration : Progress Ahead of the East African Community Monetary Union'.
- RSE annual report 2016
- RSE annual report 2017
- Rutherford D.2002. Routledge Dictionary of Economics. Routledge . Taylor & Francis Group. Second Edition. London and New York

APPENDIX