East Africa Research Papers in Economics and Finance

East Africa Collaborative Ph.D. Program in Economics and Management

An Econometric Analysis of Business Start-ups in Rwanda: Effects of Interest Rate Spread, Inflation, Exchange Rate and Taxation

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East Africa Research Papers in Economics and Finance

EARP-EF No. 2016:00

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Preface

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An Econometric Analysis of Business Start-ups in Rwanda: Effects of Interest Rate Spread, Inflation, Exchange Rate and Taxation

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Abstract

The financial sector in Rwanda has been growing rapidly in recent years, especially in the banking sector in which some regional and international commercial banks are entering the fast growing market. This paper analyses how interest rate spread, inflation, exchange rate and taxation affected business start-ups in Rwanda during 2006-2015. A co-integration approach for a long-run association between the variables and the vector errors correction model was applied to the compiled data series to arrive at the final results that reflect the prevailing situation. The analysis reveals how starting a business in Rwanda is affected by these determinant factors. The econometrics methodology was used to test a number of hypotheses based on up-to-date data. The significance of variables like interest rate spread, taxation, exchange rate and inflation was tested to evaluate their impact on business start-up conditions in Rwanda and their relationships with commercial banks. The paper also provides policy recommendations on how to promote business start-ups.

Keywords: Business start-ups; interest rate spread; inflation, exchange rate; taxation; Rwanda.

JEL Classification Codes: C22; E32; E43; F31; G12; H20; L84;

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1. Introduction

Today there is extensive literature on various aspects of economic development and on aspects like interest rate, inflation, exchange rate and taxation and their different combinations. Some econometric studies try and explain the link between the spread of interest rate and the remaining factors and several other variables such as non-performing loans, reserve requirement, lending interest rate and financial taxation. Literature in each area is comprehensive and several reviews provide overviews of the research field. For instance, Carreira and Silva (2010) studied stylized empirical results on firms' financial constraints and the effects that they have on firms. Financial constraints are found to hinder firms' abilities to carry out their optimal investment and growth trajectories. The severity of the constraints depends on institutional and firm-specific characteristics and the nature of investment projects. Fowowe (2013) provides a survey of financial liberalization in sub-Saharan Africa aimed at reversing the ill-effects of financial repression. The author finds evidence of diverse and contrasting effects on savings, investments and economic growth. In another study Becker (2015) offers a systematic review of the importance of R&D investments in explaining economic growth and the effectiveness of public R&D policies in crowding-in private R&D investments. Hanssens et al. (2016) investigated the evolution of entrepreneurial firms' debt policies. A firm's debt policy is found stable over time and determining its future debt policies.

Governments and other socioeconomic actors in different countries are very vigilant about the evolution of the spread of interest rates. Interest rate is both a facilitator and a constraint on investment opportunities in economic development. High indebtedness of states through increased interest rates and tax pressures have limited the credit market for private sector development. This shows that interest rates play a fundamental role in economic regulation with implications for economic growth and in the development of different industries and sectors in the economy.

Interest rates differ across banks and credit institutions; they also differ over time. Many factors affect the level and variations, including investment risks and supply and demand. The interest rate spread variable is a pre-occupation of many economists in business, banking and government, mainly due to its link with the investment, savings and the repayment capacities of businesses in general. A large interest rate spread is harmful for development in general and for business start-ups in particular. Definitions of various determinants related to start-ups can be different depending on the type of economic activity.

In this research, the determinants used are (though they are not necessarily limited to only these), interest rate spread, inflation, exchange rate and taxation. For example, take interest rate, for economists it is the price that allows bringing in an equilibrium between savings and investments and supply and demand for money in a market economy. This general definition is used in this study to investigate the spread in interest rate and its evolution. This study contributes to literature in a number of ways. First, it empirically investigates the relationships between interest rate spread and its determinants in a dynamic development economic environment. Second, it studies the relationship in the context of business start-ups. And finally it provides insights into windows of policy opportunities to promote business start-ups.

The rest of this study is organized as follows. General literature and that in the Rwandan context is reviewed in Section 2. Section 3 discusses business start-ups in Rwanda; it

explains the current state, development over time, potential for further development, key components and the role of the government as an introduction to the sector. Research methods and techniques are presented in Section 4. The data, models and analysis of the empirical results are presented in Section 5. The last section provides a conclusion and also important recommendations on effective use of the findings to promote business start-ups in Rwanda.

2. Related literature

A number of reviews on start-ups and financial constraints, the evolution of debt and public finance policies and stability of firms' debt structures are mentioned in the Introduction. The reasons for an increase in interest rates in less developed countries are almost the same; the only difference lies in the structure of the financial system in each country and in how money functions in that system.

2.1 General context

Barajas et al. (2000) conducted a study on this subject in Colombia. They indicate that during 1974-96 the spread of interest rate in public banks was 24.6 per cent. They used both a model of a multiple linear regression equation and a simultaneous equations model to explain the factors behind the spread of interest rates. The explanatory variables that they used in their study are taxes, functions of variable costs including wages and non-performing loans.

Randall, (Randall, 1998) in his study covering eight countries of the Eastern Caribbean Currency Union (ECCU), used income statements and consolidated balance sheets of commercial banks to determine interest rates using an accounting approach. The author acknowledges that this descriptive approach does not clearly capture the behavior of start-ups. To overcome this shortcoming, the author introduced a model based on competition between banks. The model introduced price elasticities of demand for loans and demand for deposits as key variables in determining the potential impact of any change in the determinants of interest rates.

Based on the existence of simultaneity in the formulation of supply and demand models, Randal, (Randall, 1998) used a system of simultaneous equations. Using 24 quarterly observations for each of the eight countries in the ECCU region over six years (1991-96), the determinants of the spread of interest rates were obtained by alternative least squares. The econometric results for these countries show that economic growth was negatively correlated with interest rates. An increase in deposits raised the spread of interest rates due to an increase in the cost of resources and an increase in administrative costs. A 1.2 per cent increase in the supply of lendable deposits led to an increase of 1 per cent in lending interest rates. A 1 per cent increase in lending interest rates was due to a decrease of 4.6 per cent in the demand for lendable funds.

Youngblood and Franklin (2008) conducted a study in Ghana. He noted that the market share in the banking system explained the overall behavior of banks and found that there is a lack of perfect competition in starting a business due to the banking system in the country. In addition, high operating costs, largely dominated by wages as well as bank net profits had a significant impact on the increase in the spread of interest rates in the

country. The study also shows that cash banks, taxation and inflation exchange rate may also have a significant impact on the gap between interest rates even if their impact is smaller than that of operating costs.

A study by Jayaraman et al. (2003) shows that Pacific island nations and the Caribbean have higher interest rates than Fiji islands which have a relatively lower bank interest rate spread. The study also shows that the main problems in starting a business are (in order of magnitude): bank net profits (65 per cent), operating costs (6 per cent), taxation (5 per cent) inflation (5 per cent), exchange rate (7 per cent) and non-performing loans (12 per cent). Further, the study notes that income other than interest (fees and commissions) is an important element in reducing the spread of interest rates as it can compensate for any increase because of the variables mentioned earlier. The authors say: "The Fijian oligopolistic market structure gives room to banks on the unfair basis and seems to be selective, accepting only a limited number of small enterprises that can be provided loans in order to maximize their profit."

2.2 The Rwandan context

Like central banks in many countries, the National Bank of Rwanda (BNR) ensures the supervision of banks in the monetary and financial sectors. It introduces Rwanda's monetary policy using tools of control such as reserve requirements, issue of treasury bills and bonds. BNR also intervenes in the creation of necessary liquidity or in the withdrawal of excess liquidity. The policy includes aspects of currency or exchange rate stabilization.

Regarding the management of liquidity, the banking system in Rwanda has been in a situation of permanent excess cash for many years. In order to adjust the banking liquidity to monetary measures, BNR has intervened by borrowing on the monetary market and by selling foreign currency in commercial banks in order to reduce the excess liquidity. This government borrowing system resulted in an increase of 16.2 per cent in the total domestic loans given by the central bank to commercial banks.

The lending interest rate charged by commercial banks is still at a high level averaging at 18 per cent, while the deposit interest rate keeps decreasing. In 2010, it was 7.1 per cent for a maturity period of three months. The large gap between lending and saving interest rates discourages savings and starting new businesses (BNR Economic Review, 2011 and 2012).

3. Business start-ups in Rwanda

Starting a business in Rwanda requires an entrepreneur to plan and take decisions with respect to a number of important issues. These include decisions in relation to location, the size of the start-up, investments required, contact with supportive institutions and if the firm does not want to remain in the informal sector then ensuring that it moves to the formal sector by registering with the Business Registration Office, Rwanda Development Board (source: http://www.rdb.rw).

3.1 Current state

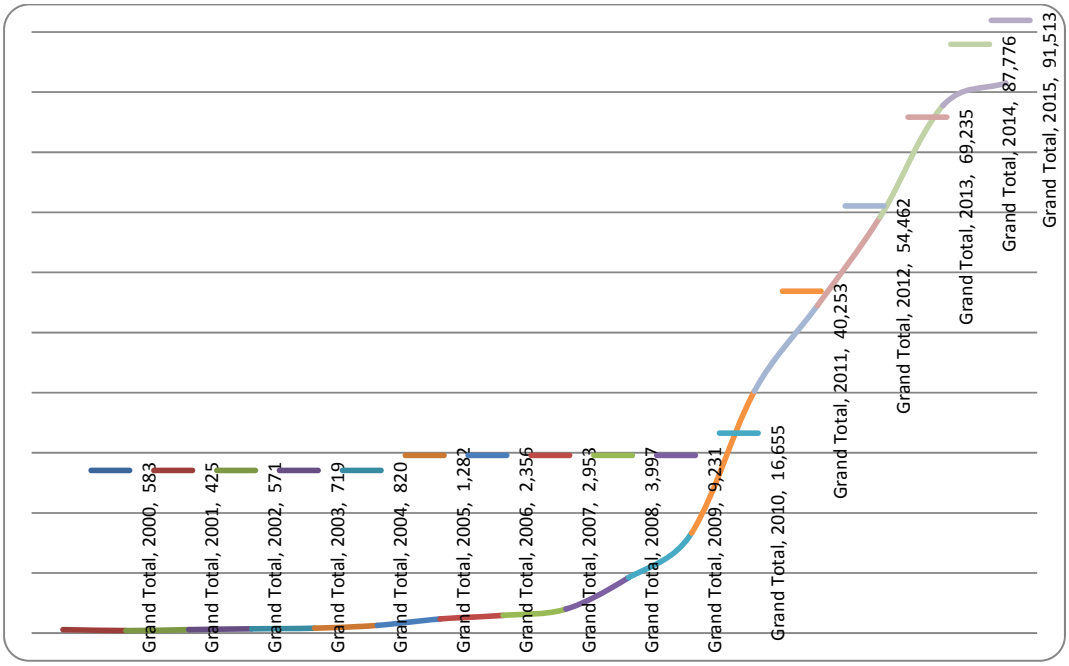
Government agency, the Rwanda Development Board (RDB), is responsible for promoting investments and facilitating market entry for investors in both the public and private sectors. It is often a good place to start when one is considering establishing a business in Rwanda. RDB offers a range of services to potential investors, including assistance to acquire licenses, certificates, approvals, authorizations and permits required by law to set up and operate a business enterprise in Rwanda. These five may seem similar but together they provide all necessary documents characterizing a formal enterprise with legal protection, rights and obligations.

In Rwanda a business can be registered as an individual business with national, foreign or joint ownership. Registering a company in Rwanda is done online and it takes less than a week to obtain a Certificate of Incorporation. The registrar's office at RDB acts as a one-stop shop which takes care of all formalities relating to the registration of a start-up in the country. This process has rationalized complex procedures and helps in attracting foreign and national investors to establish companies in Rwanda.

3.2 Development over time

Figure 1 shows the development of entrepreneurship in Rwanda in 2000-2015. It shows that a large number of new businesses were registered during this time. We can see that from 2011 there has been a steep upward trend. This is explained by the fact that this was the year when new businesses were encouraged to register using the online system.

Figure 1. New businesses registration trend: 2000-2015



Source: Calculations based on the Office of the Registrar General's (ORG's) data.

Annual data show that in 2015 the growth rate in registering new businesses reduced to 4 per cent (91,513) from 27 per cent in 2014 (87,776) and in 2013 (69,235). From 2015 most registered firms are start-ups; they are not transitions from informal to formal status. In addition to the success of online firm registration, urbanization is also rapidly making progress leading to high growth rates in new entrepreneurship.

3.3 Potential for further development

ORG is committed to promoting Rwanda as a preferred investment destination. This commitment is practiced through the provision of world class registration services and systems, provision of updated and quick information to all clients and improved business operations in the country. The aim is to achieve stated national goals through developing and ensuring compliance with a modern and internationally competitive corporate governance framework.

3.4 Key components and government rule

Three steps are required for getting an investment certificate: an application for an investment registration, notice of acceptance or refusal and issuance of an investment registration certificate.

The application for investment registration involves the following steps:

A. Application letter requesting investment registration;

B. Submission of a business plan or a feasibility study;

C. Shareholding structure sheet; and

D. Certificate of the company's incorporation.

The investment application letter should clearly indicate the following: the name and address of the proposed business enterprise and its legal form; the nature of the proposed business activity and the level of planned capital investment; the estimated number of persons to be employed and categories of jobs to be created; the nature and volume of waste which will be generated by the enterprise's operations and proposed methods for its management; and the nature of support and facilitation which the investor is seeking from RDB.

The investment business plan or feasibility study should clearly indicate the state of the following 13 items:

1. Executive summary of the project;
2. Profile of the project promoter(s);
3. Project background;
4. Market study or market analysis;
5. Investment plan over a five-year period;
6. The level of loans and equity financing;
7. Projected statement of income and expenditure five years ahead;

8. Projected balance sheet (five years ahead);
9. Projected statement of cash flows (five years ahead);
10. Payback period, net present value (NPV) and investment return rate (IRR);
11. Loan amortization schedule for a bank loan (if any);
12. Project implementation plan/schedule; and
13. Notes on assumptions made in the business plan.

Once the application for investment registration is approved an acceptance letter for the project is issued. Otherwise, a notice of refusal and the reason for the refusal is given. In case the documents are not in order or the information provided is inadequate improvements are requested. Upon the receipt of proof of payment, an investment registration certificate is issued. The investment certificate allows access to investment incentives provided in the investment code. It takes two days to process the application and issue the certificate of investment registration if all documents are submitted and they are in order.

Finally, there are a number of criteria related to an investment project's evaluation, including level of investment, non-trading activity, creation of high skill and quality jobs, transfer of skills and technology, use of local raw materials, potential for export, potential to create backward and forward linkages and innovation and creativity.

4. Methodology

All scientific research requires methods and techniques for collecting and analyzing data on the subject of the study. The following methods and techniques were used in this study.

Grawitz, (1979) defines 'method' as all the intellectual operations by which a discipline seeks to achieve the truths it pursues, in showing and verifying them. In this research three research methods were used. First, the comparative method allowed us to compare the influences that the various factors have on starting a business in Rwanda. Second, we also used the dialectical method that integrates the inductive and deductive approaches. Indeed, we combined empirical facts with reasoning to clarify various aspects of starting a business in Rwanda. Finally, the systems approach clarified the impact of various economic factors on starting a business.

The techniques used are rigorous operative procedures, which are well-defined and transmittable and which can be applied again under the same conditions adapted to similar problems and phenomena Grawitz (1979). An attempt was also made to follow Grawitz's definition of techniques. The techniques employed in this study include: (i) the documentary technique which helped in consulting documents related to the subject such as books, magazines, papers, reports and the internet, (ii) the statistical technique for the data, and (iii) EViews in an econometric analysis of the behavior of starting a business in Rwanda between 2006-15.

5. Data and econometric model

The purpose of this section is to empirically verify the validity of the theories developed

over the years in economic practices in Rwanda. This was done through statistical techniques for collecting and analyzing data and using methods of estimating econometric models to identify the main determinants or factors, in particular in the interest rate spread, inflation, exchange rate and taxes that influence starting a business in Rwanda.

Our econometric analysis involved a study of the influence of interest rate spread (lending rate minus deposit rate), inflation rate, exchange rate (FRW/USD), and taxation (measured by the tax on goods and services) on starting a business in Rwanda. Starting a business in Rwanda is measured by the number of new entrants in business irrespective of economic sectors. Sectorial heterogeneity in responses to changes in the factors mentioned earlier is controlled for.

Appendix 1 presents the data that have been used in our regressing model. These data were provided by the National Institute of Statistics of Rwanda (NISR) in conjunction with the National Bank of Rwanda (BNR). Other data were collected from the Rwanda Development Board (RDB). Availability of ready and workable data pushed us to use unique quarterly data from 2006 to 2015 for the econometric analysis.

The econometric model of starting a business as a function of its determinants is specified as follows:

$$(1) \qquad BS = \alpha + \beta_1 IRS + \beta_2 INF + \beta_3 ER + \beta_4 TAX + \varepsilon$$

where the dependent variable is new business start-ups (*BS*), independent variables include interest rate spread (*IRS*), inflation (*INF*), exchange rate (*ER*) and taxation (*TAX*). The model is appended with a random error term (ε) to take into account the fact that the model is supposed not to fully represent the actual relationship between the above independent variables and the dependent variable (*BS*).

5.1 Model specification and testing

Some time series models do not respect basic principles of stationarity and co-integration which implies tests before any estimation. Therefore, we had to test stationarity and co-integration of our variables *BS*, *IRS*, *IFL*, *ER*, and *TAX*.

The following three conditions must be fulfilled for a series to be stationary:

- either $E(Y_t) = E(Y_{t+m}) = \mu$, $\forall vt$ and $\forall vm$, the mean is independent of time.
- $var(Y_t) \neq \infty$, the variance is finite and independent of time.
- $cov(Y_t, Y_{t+k}) = E[(Y_t - \mu)(Y_{t+k} - \mu) = \gamma_k$, the covariance is independent of time.

where Y refers to business start-ups BS. In short, for a series to be stationary it is necessary that its mean, its variance and its auto-covariance do not change over time. Note that a series that is not stationary in the sense defined here is called non-stationary. A chronological stationary series is important because if it is not stationary, we can study the behavior for a given period only. Therefore, it is not possible to make a generalization for other periods. Such non-stationary series will have no reliable practical value. Similarly, the student test (t-test) cannot be used. Therefore, as noted by Granger, a co-integration test can be thought to be a pre-test to avoid a fake regression situation (Engle

and Granger, 1986: 226).

The stationarity test was used to test that the null hypothesis H_0: $\alpha-1 = 0$ (non-stationary) and the alternative hypothesis H_1: $\alpha-1 < 0$ (stationary) for the following models:

1) $\Delta Y_t=(\alpha-1)Y_{t-1}+\nu_t$ Model with no intercept or trend

2) $\Delta Y_t=\beta_0+(\alpha-1)Y_{t-1}+\nu_t$ Model with intercept but without tendency

3) $\Delta Y_t=\beta_0+\beta_1 t+(\alpha-1)Y_{t-1}+\nu_t$ Model with intercept and trend

where Y refers to business start-ups, BS in our model. We have a unit root if $\alpha=1$ and the model is non-stationary. In this case the statistic τ (tau) replaces the student test. The Augmented Dickey-Fuller (ADF) test was used by adding more differentiated terms Y_t (that is, $\alpha_i\sum_{i=l}\Delta Y_{t-l}$) to correct errors in the auto-correlation model of DF. Thus, the properties of constant mean, variance and covariance and stationarity allow for the generalization of the result across time periods.

5.2 Model testing

A) Test of variables' stationarity

Tables A1-A6 (Appendix II) helped us choose the optimum lag length to use for the Augmented Dicky-Fuller (ADF) test. After comparing the critical values in each table by identifying the minimum Akaike information criterion, the lag length for BS is 2; it is 1 for INF; while IRS, ER and TAX variables do not require any lag value for the stationarity test as their P, lag length, is equal to 0.

A1. ADF test for the BS variable

Table 1 below shows the results of the ADF test for the new business start-ups (BS) variable and its first difference.

Table 1. Results of ADF test for BS variable and its first difference

Model	ADF test statistic	Test critical values: 1 per cent	Test critical values: 5 per cent	Test critical values: 10 per cent
BS variable:				
Trend and intercept	-2.0849	-4.2268	-3.5366	-3.2003
Intercept	1.3789	-3.6210	-2.9434	-2.6102
None	3.1570	-2.6289	-1.9501	-1.6113
BS first difference:				
Trend and intercept	-5.9021	-4.2268	-3.5366	-3.2003
Intercept	-5.3628	-3.6210	-2.9434	-2.6102
None	-3.8260	-2.6289	-1.9501	-1.6113

Table 1 shows that the BS variable is not stationary as all test critical values for all levels (1 per cent, 5 per cent and 10 per cent) are less that their corresponding ADF test statistics. To make this variable stationary we differentiated it and applied the ADF test to its first difference. The results are presented in the second half of Table 1. The table shows that BS is integrated of order 1 as its first difference is stationary.

A2. ADF test for the IRS variable

Table 2 below shows the ADF test for interest rate spread (IRS) and its first difference.

Table 2. Results of the ADF test for the IRS variable and its first difference

Model	ADF test statistic	Test critical values: 1 per cent	Test critical values: 5 per cent	Test critical values: 10 per cent
IRS variable:				
Trend and intercept	-2.4553	-4.2118	-3.5297	-3.1964
Intercept	-2.4808	-3.6104	-2.9389	-2.6079
None	0.0839	-2.6256	-1.9496	-1.6115
IRS first difference:				
Trend and intercept	-5.7066	-4.2191	-3.5330	-3.1983
Intercept	-5.7687	-3.6155	-2.9411	-2.6090
None	-5.8272	-2.6272	-1.9498	-1.6114

Table 2 shows that the IRS variable is not stationary. Its first difference was tested and the results are presented in the second part of Table 2. Consequently, Table 2 shows that IRS is integrated of order 1. All its test critical values are greater than their corresponding ADF test statistics.

A3. ADF test for the INF variable

Table 3 below shows the ADF test for the inflation rate (INF) variable and its first difference.

Table 3. Results of the ADF test for the INF variable and its first difference

Model	ADF test statistic	Test critical values: 1 per cent	Test critical values: 5 per cent	Test critical values: 10 per cent
Trend and intercept	-3.5971	-4.2191	-3.5330	-3.1983
Intercept	-2.4193	-3.6155	-2.9411	-2.6090
None	-1.7002	-2.6272	-1.9498	-1.6114

Table 3 shows that the INF variable is stationary: the test critical values are greater than the ADF test statistics at 5 per cent and 10 per cent with trend and intercept and also at 10 per cent without trend and intercept.

A4. ADF test for the ER variable

Table 4 below shwas the ADF test results for the exchange rate (ER) variable and its first difference.

Table 4. Results of the ADF test for the ER variable

Model	ADF test statistic	Test critical values: 1 per cent	Test critical values: 5 per cent	Test critical values: 10 per cent
ER variable:				
Trend and intercept	-0.6435	-4.2118	-3.5297	-3.1964
Intercept	4.4021	-3.6104	-2.9389	-2.6079
None	5.7040	-2.6256	-1.9496	-1.6115
ER first difference:				
Trend and intercept	-6.7146	-4.2191	-3.5330	-3.1983
Intercept	-4.2381	-3.6155	-2.9411	-2.6090
None	-2.7197	-2.6272	-1.9498	-1.6114

Table 4 shows that the ER variable is not stationary: the test critical values are less than their corresponding ADF test statistics at 1 per cent, 5 per cent and 10 per cent. To make the ER variable stationary we differentiated it and applied the ADF test to its first difference which resulted in the ER being integrated of order 1 as its first difference is stationary.

A5. ADF test for the TAX variable

Table 5 below shows the ADF test results for the tax rate variable (TAX) and its first difference.

Table 5. Results of the ADF test for the TAX variable and its first difference

Model	ADF test statistic	Test critical values: 1 per cent	Test critical values: 5 per cent	Test critical values: 10 per cent
TAX variable:				
Trend and intercept	-2.4190	-4.2118	-3.5297	-3.1964
Intercept	-0.5662	-3.6104	-2.9389	-2.6079
None	2.7993	-2.6256	-1.9496	-1.6115

TAX first difference:				
Trend and intercept	-5.4973	-4.2191	-3.5330	-3.1983
Intercept	-5.5720	-3.6155	-2.9411	-2.6090
None	-4.5462	-2.6272	-1.9498	-1.6114

Table 5 shows that the TAX variable is not stationary. To make the TAX variable stationary we differentiated it and applied the ADF test to its first difference. The results are presented in Table 5. In conclusion, the ADF test revealed that only the inflation rate (INF) variable was stationary while other variables were not stationary but that their first differences were stationary. This means that they are integrated of order 1.

B. Co-integration test

We first estimated the following model:

(2) $BS = \alpha + \beta_1 IRS + \beta_2 INF + \beta_3 ER + \beta_4 TAX + \varepsilon$

After estimation we obtained:

$$BS = -42766.6 - 710.1\,IRS + 28.2\,INF + 79.7\,ER + 0.1\,TAX$$

$$t\text{-value}\ (-4.9494)\ (-2.6813)\ (0.3989)\ (4.9280)\ (4.5493)$$

Then, we carried out the stationarity test of residuals which are presented in Table 6.

Table 6. Results of the ADF test for residuals

Model	ADF test statistic	Test critical values: 1 per cent	Test critical values: 5 per cent	Test critical values: 10 per cent
Trend and intercept	-4.5105	-4.2191	-3.5330	-3.1983
Intercept	-4.6046	-3.6155	-2.9411	-2.6090
None	-4.6800	-2.6272	-1.9498	-1.6114

The test results in Table 6 show that all residuals are stationary since their ADF test statistics are less than their corresponding critical values which implies that interest rate spread (IRS), inflation rate (INF), exchange rate (ER) and taxation (TAX) grow together in the long run when one starts a new business in Rwanda.

5.3 Estimation of long-run and short-run models

A. Long-run relation

The estimated model of business start-ups as a function of its key determinants is:

(3) $BS = \alpha + \beta_1 IRS + \beta_2 INF + \beta_3 ER + \beta_4 TAX + \varepsilon$

The ordinary least square (OLS) method gives the following results (see also Appendix

III for detailed results):

$$b = -42766.6 - 710.1\,IRS + 28.2\,INF + 79.7\,ER + 0.1\,TAX$$

$$\text{t-value } (-4.9494) \quad (-2.6813) \quad (0.3989) \quad (4.9280) \quad (4.5493)$$

The results indicate that our model explains more than 95 per cent of the variations in the number of start-ups in Rwanda. The estimations show that all coefficients are statistically significant except for inflation (INF) and that multi-collinearity is almost not present. This means that in the long-run, the number of new businesses increases and grows with interest rate spread (IRS), FRW/USD exchange rate (ER) and taxes (TAX); and that inflation rate (INF) does not follow the increase in start-ups over time.

Note that we used 40 observations for each variable which are quarterly data flows from 2006 to 2015 with some provisional data which have not yet been officially released for the last quarter of 2015.

In addition, the auto-correlation of errors and heteroscedasticity were absent according to the tests conducted, since all test probabilities were higher than the degree of significance of 5 per cent apart from inflation rate with the test probability of 0.6923 (see Appendix III).

B. Short-run relation

Granger has postulated that if we have co-integration we can estimate the short-run relation by using the error correction model. For our case the start-up model is:

$$(4) \qquad \Delta BS_t = \alpha_0 + \alpha_1 \Delta IRS_t + \alpha_2 \Delta INF_t + \alpha_3 \Delta ER_t + \alpha_4 \Delta TAX_t + \alpha_5 U_{t-1} + \mathcal{E}_{1t}$$

The summary results after estimation are (also see Appendix IV):

$$\Delta BS_t = 498.366 + 205.788\Delta IRS_t + 54.987\Delta INF_t + 12.821\Delta ER_t + 0.009\Delta TAX_t - 0.504\,U_{t-1}$$

$$\text{t-value} \quad (1.658) \quad (0.720) \quad (0.756) \quad (0.327) \quad (0.158) \quad (-3.525)$$

As the probability of the lagged residuals (Appendix IV) is less than 5 per cent we conclude that the coefficient α_5 is significant as the model specifies. It is worth mentioning that this coefficient must have a negative sign as it is made of forces that drive to the long-run equilibrium while other coefficients are like shocks in each period towards the equilibrium.

From the results we can see that other things being equal, if the interest rate spread (IRS) increases by 1 per cent then 206 new businesses (BS) follow; if the inflation rate (INF) rises by 1 per cent, 55 new businesses are born; and if the FRW/USD exchange rate (ER) increases by 1 FRW then 13 new businesses are started. The interest rate spread seems to have the strongest effect on start-ups in Rwanda while the exchange rate has the weakest effect.

Finally, 50.4 per cent of the shocks are eliminated every quarter by new businesses starting in Rwanda thus requiring a year, 11 months and 24 days to reach the long-run equilibrium. Note that in the short-run our model explains 32 per cent of the variations in starting a new business in Rwanda.

6. Summary, conclusion and recommendations

The theoretical part of this study showed that the interest rate spread is the pre-occupation of many economic theories and models in business, banking and government, mainly due to its link with investments, savings and firms' repayment capacities. The various determinants related to starting new businesses were identified as the interest rate spread, inflation, exchange rate and taxation. In addition it was noted that income sources other than interest rate are important elements in reducing the spread of interest rates.

Based on empirical results, the following recommendations are made. First, commercial banks should review the cost of financial intermediation and analyze and track the sectors that they finance and the securities that they receive from borrowers in order to reduce the lending interest rate by hiring qualified staff and looking at how they can apply up-to-date information technology tools in both soft and hard forms. Second, in order to stimulate savings, commercial banks are advised to increase deposit interest rates to the optimum level. Third, the central bank is advised to set up a financial system that aims at reducing the interest rate spread by playing on the determinants of the reference rate of interest. Fourth, the central bank should increase its focus on price stability, a stable FRW/USD exchange rate and also pay greater attention to securing low-cost finance for investments. Fifth, concerned officials should also encourage the establishment of a financial market that is effective in addressing the lack of long-term investments. Thus, business start-ups and interest rate spread, inflation, exchange rate and taxation will grow in harmony. Finally, future researchers need to analyze the determinants of the reference rate of interest.

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Appendix I: Data used in the analysis

Quarter	New business (BS)	Interest rate spread (IRS)	Inflation rate (INF)	FRW/USD Exchange rate (ER)	Tax on products, millions FRW(TAX)
2006 Q1	544	7.4	8.6	553.4	28,085
2006 Q2	403	7.4	11.8	551.9	29,885
2006 Q3	701	7.9	11.8	551.7	32,519
2006 Q4	708	8.0	15.0	550.2	33,158
2007 Q1	690	8.1	15.3	548.2	34,286
2007 Q2	675	8.2	10.3	546.0	37,809
2007 Q3	848	8.5	10.4	548.4	37,356
2007 Q4	740	8.6	7.6	545.6	40,878
2008 Q1	889	10.2	5.7	543.6	43,243
2008 Q2	974	10.4	13.5	543.1	45,754
2008 Q3	1026	10.1	19.8	547.5	53,770
2008 Q4	1108	10.0	23.2	552.7	60,711
2009 Q1	2332	10.2	16.6	563.6	58,818
2009 Q2	1923	8.1	10.7	563.8	55,215
2009 Q3	2464	8.4	6.8	564.6	53,990
2009 Q4	2512	7.9	6.3	566.4	57,162
2010 Q1	3524	9.5	2.7	583.1	57,527
2010 Q2	3104	10.3	5.9	578.6	56,777
2010 Q3	4371	10.8	1.7	589.0	63,929
2010 Q4	5656	10.4	-0.1	592.4	70,305
2011 Q1	7237	8.9	3.9	600.3	70,875
2011 Q2	9235	8.5	5.1	599.3	75,667
2011 Q3	11278	9.3	5.7	599.8	78,391
2011 Q4	12503	9.0	8.3	601.8	79,365
2012 Q1	12380	8.6	9.0	605.1	83,386
2012 Q2	14036	8.2	6.8	608.6	85,116
2012 Q3	14333	8.3	6.8	613.6	94,409
2012 Q4	13713	6.2	4.1	628.8	88,655
2013 Q1	14722	6.5	3.2	633.2	89,136
2013 Q2	17496	6.6	4.1	640.1	95,407
2013 Q3	18270	8.2	5.7	649.0	103,106
2013 Q4	18747	8.6	4.1	664.3	106,075
2014 Q1	20765	8.8	3.8	674.6	111,160
2014 Q2	19300	8.7	2.1	681.4	126,666
2014 Q3	23441	9.1	-0.2	684.2	122,232
2014 Q4	24270	9.5	2.2	690.3	116,756
2015 Q1	20319	9.1	1.2	702.3	116,769
2015 Q2	19014	9.0	2.8	712.1	116,769

2015 Q3	23647	9.1	2.8	725.0	116,769
2015 Q4	28533	9.2	2.8	739.0	116,769

Appendix II: Lag length choice for each variable and equation's residuals

Table A1. Table of Akaike and Schwarz criteria for BS

P	Model 1: with intercept		Model 2: with trend and intercept		Model 3: without trend and intercept	
	Akaike	Schwarz	Akaike	Schwarz	Akaike	Schwarz
5	17.5485	17.7227	17.4113	17.6290	17.5632	17.6938
4	17.5485	17.7227	17.4113	17.6290	17.5632	17.6938
3	17.5485	17.7227	17.4113	17.6290	17.5632	17.6938
2	17.5485	17.7227	17.4113	17.6290	17.5632	17.6938
1	17.6418	17.7271	17.5442	17.6722	17.6180	17.6606
0	17.6418	17.7271	17.5442	17.6722	17.6180	17.6606

P = 2

Table A2. Table of Akaike and Schwarz criteria for IRS

P	Model 1: with intercept		Model 2: with trend and intercept		Model 3: without trend and intercept	
	Akaike	Schwarz	Akaike	Schwarz	Akaike	Schwarz
5	2.2992	2.4734	2.3456	2.5633	2.3495	2.3921
4	2.2992	2.4734	2.3456	2.5633	2.3495	2.3921
3	2.2434	2.3287	2.3456	2.5633	2.3495	2.3921
2	2.2434	2.3287	2.2909	2.4189	2.3495	2.3921
1	2.24347	2.3287	2.2909	2.4189	2.3495	2.3921
0	2.2434	2.3287	2.2909	2.4189	2.3495	2.3921

P = 0

Table A3. Table of Akaike and Schwarz criteria for INF

P	Model 1: with intercept		Model 2: with trend and intercept		Model 3: without trend and intercept	
	Akaike	Schwarz	Akaike	Schwarz	Akaike	Schwarz
5	5.0285	5.1577	4.9130	5.0854	5.0578	5.1440
4	5.0285	5.1577	4.9130	5.0854	5.0578	5.1440
3	5.0285	5.1577	4.9130	5.0854	5.0578	5.1440
2	5.0285	5.1577	4.9130	5.0854	5.0578	5.1440
1	5.0285	5.1577	4.9130	5.0854	5.0578	5.1440
0	5.1065	5.1918	5.0462	5.1742	5.0942	5.1369

P = 1

Table A4. Table of Akaike and Schwarz criteria for ER

P	Model 1: with intercept		Model 2: with trend and intercept		Model 3: without trend and intercept	
	Akaike	Schwarz	Akaike	Schwarz	Akaike	Schwarz
5	5.9968	6.0821	5.9196	6.0476	6.1973	6.4195
4	5.9968	6.0821	5.9196	6.0476	6.1973	6.4195
3	5.9968	6.0821	5.9196	6.0476	6.2043	6.3349
2	5.9968	6.0821	5.9196	6.0476	6.2043	6.3349
1	5.9968	6.0821	5.9196	6.0476	6.2640	6.3502
0	5.9968	6.0821	5.9196	6.0476	6.2784	6.3211

P = 0

Table A5. Table of Akaike and Schwarz criteria for TAX

P	Model 1: with intercept		Model 2: with trend and intercept		Model 3: without trend and intercept	
	Akaike	Schwarz	Akaike	Schwarz	Akaike	Schwarz
5	19.5970	19.6823	19.5196	19.6920	19.6286	19.6713
4	19.5970	19.6823	19.5196	19.6920	19.6286	19.6713
3	19.5970	19.6823	19.5196	19.6920	19.6286	19.6713
2	19.5970	19.6823	19.5196	19.6920	19.6286	19.6713
1	19.5970	19.6823	19.5196	19.6920	19.6286	19.6713
0	19.5970	19.6823	19.5056	19.6336	19.6286	19.6713

P = 0

Table A 6. Table of Akaike and Schwarz criteria for equation's residuals

P	Model1: with intercept		Model 2: with trend and intercept		Model 3: without trend and intercept	
	Akaike	Schwarz	Akaike	Schwarz	Akaike	Schwarz
5	17.5993	17.7286	17.6503	17.8227	17.5467	17.6329
4	17.5993	17.7286	17.6503	17.8227	17.5467	17.6329
3	17.5993	17.7286	17.6503	17.8227	17.5467	17.6329
2	17.5993	17.7286	17.6503	17.8227	17.5467	17.6329
1	17.5993	17.7286	17.6503	17.8227	17.5467	17.6329
0	17.6513	17.7366	17.6999	17.8278	17.6002	17.6428

P = 1

Appendix III: Estimation of the long-run model

Dependent Variable: N
Method: Least Squares
Date: 04/12/16 Time: 02:15
Sample: 1 40
Included observations: 40

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	-42766.56	8640.751	-4.949404	0.0000
IS	-710.0606	264.8132	-2.681364	0.0111
INF	28.22257	70.73529	0.398989	0.6923
E	79.69530	16.17169	4.928076	0.0000
TAX	0.135094	0.029695	4.549324	0.0001

R-squared	0.963284	Mean dependent var	9460.775
Adjusted R-squared	0.959088	S.D. dependent var	8748.631
S.E. of regression	1769.552	Akaike info criterion	17.91131
Sum squared resid	1.10E+08	Schwarz criterion	18.12242
Log likelihood	-353.2262	Hannan-Quinn criter.	17.98764
F-statistic	229.5687	Durbin-Watson stat	1.230562
Prob(F-statistic)	0.000000		

Appendix IV: Estimation of the short-run model

Dependent Variable: DN
Method: Least Squares
Date: 04/12/16 Time: 04:49
Sample: 1 38
Included observations: 38

Variable	Coefficient	Std. Error	t-Statistic	Prob.
C	498.3664	300.5135	1.658383	0.1070
DIS	205.7875	285.8153	0.720002	0.4768
DINF	54.98687	72.78132	0.755508	0.4555
DE	12.82119	39.19752	0.327092	0.7457
DTAX	0.008585	0.054443	0.157679	0.8757
LAGRESID01	-0.504237	0.143035	-3.525262	0.0013

R-squared	0.318660	Mean dependent var	607.9737
Adjusted R-squared	0.212201	S.D. dependent var	1473.449
S.E. of regression	1307.804	Akaike info criterion	17.33403
Sum squared resid	54731242	Schwarz criterion	17.59259
Log likelihood	-323.3465	Hannan-Quinn criter.	17.42602
F-statistic	2.993260	Durbin-Watson stat	1.540215
Prob(F-statistic)	0.025071		