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Domestic Saving-Investment Correlation Puzzle Revisited: A Time Series Analysis for South Africa.

Rajarshi Mitra
National Research University Higher School of Economics

Abstract

The correlation between domestic saving and investment rates and its implications for international capital flows is well documented. This paper re-examines the short-run and long-run domestic saving-investment correlation in South Africa. The period of study is 1960-2014. Domestic saving rate is found to have significantly positive long-run effect on domestic investment rate. Granger causality indicates short-run bidirectional causality between domestic saving and investment rates. Domestic saving policies could, therefore, be expected to significantly increase domestic investment in South Africa.

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Contact: Rajarshi Mitra - rmitra400@gmail.com.
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1. Introduction

The economy of South Africa is more diversified today than it has ever been before. Despite increases in GDP and foreign exchange reserves, the country continues to suffer from high unemployment rate, unequal income distribution and high government debt, amongst numerous other factors such as low level of education and high crime rate. The government, over the years, has implemented policies to control inflation and attract foreign capital. Efforts have been made to increase the pace of privatisation, increase government spending and lower interest rates in order to attract more foreign investment. According to the World Bank statistics, annual percentage growth in GDP was 3.85% in 1961. It increased to 8.90% in 1969 and stood at just 1.52% in 2014. The real interest rate was 5.50% in 1961, which increased to 13.0% in 1998 and then fell to 3.14% in 2014. The deposit and lending rates in 2014 were 5.80% and 9.13% respectively. There is overall a downward trend in saving and investment rates during the period 1960-2014.

Although both inflation and interest rates have fallen, annual GDP growth rate and growth rate of per-capita real GDP have been rather low. It is commonly believed that the persistently high crime rate acts as a severe constraint on foreign investment in the economy, and could possibly be a major reason why South Africa has generally struggled to attract FDI. Consequently, the need for more domestic investment as a means to stimulate economic growth has gained increasing importance.

With South Africa now being part of some of the major regional trade blocs and agreements that enhances capital mobility across countries both within the African region and globally, in lines with Feldstein and Horioka (1980), two important questions that the economy faces from the standpoint of the effectiveness of fiscal and monetary policies are: (a) how close and significant is the correlation between domestic saving and investment rates in South Africa, and (b) does a larger fraction of domestic savings remain in the country or is it invested abroad?

Although studies have argued both for and against the use of domestic saving-investment correlation as an indicator of capital mobility and financial integration, the Feldstein and Horioka (1980) study remains one of the major puzzles in international macroeconomics. Most empirical studies have reported high saving-investment correlation coefficients for developed economies and relatively low and insignificant coefficients for developing economies. Studies based on time series analysis, apart from identifying a long-run relationship, have emphasized on the existence of unidirectional causality from domestic saving rate to investment rate in order to examine the effectiveness of saving policies.

This paper focuses on the domestic saving-investment correlation in South Africa, based on time series analysis. The motivation for this paper stems from the lack of uniformity in results observed across countries in previous empirical studies. Even for the same country, the results are mostly conflicting and vary greatly across sample periods and econometric methodologies. The lack of general consensus on the sign and significance of the coefficient estimates observed in exiting studies, therefore, necessitates a re-investigation of the domestic saving-investment correlation in South Africa. This paper estimates a vector error correction model and examines the short-run and the long-run domestic saving-investment correlation in South Africa over the period 1960-2014. The country specific factors and the implications for capital mobility and financial integration are discussed.

2. Literature Review

Since Feldstein and Horioka (1980) numerous studies have examined the domestic saving-investment correlation and its implications for capital mobility across countries. In general, a higher correlation coefficient has been observed for high-income developed economies relative to small developing economies. Murphy (1984), Wong (1990), Mamingi (1997), Coakley et al. (1999) and Kasuga (2004) observed weak and low correlation coefficients for developing economies. Dooley et al. (1987), Schmidt (2001) and Mark et al. (2005) reported higher long-run saving-investment correlation for OECD countries relative to non-OECD countries. Guillaumin (2009) reported stronger financial integration for high-income countries. In a recent study, Adeniyi and Egwaikhide (2013) reported low saving-retention coefficients for sub-Saharan countries. Feldstein and Bacchetta (1991) found that a nation's saving-rate would Granger cause its investment-rate. But Schmidt (2001) observed limited effectiveness of saving policies for enhancing domestic investment. In other studies, while Swamy (1971), Feldstein (1983), Amirkhalkhali and Dar (1993), Montiel (1994), Jansen (1996), Jansen and Schultz (1996), Jansen (1997), De Vita and Abbott (2002), Pelagidis and Mastroyiannis (2003), Corbin (2004), Kellerman (2005), Adedeji and Thornton (2008), Li (2010), Eslamloueyan and Jafari (2010) and Iorio and Fachin (2014) observed significant relationship between domestic savings and investment, Krol (1996) and Coakley et al. (2004) reported low and insignificant relationship between domestic savings and investment.

In studies exclusively on South Africa, the authors observed long-run (cointegrating) relationships between domestic saving and investment rates. For instance, Agbetsiafa (2002), using data over the period 1960-1998, found evidence of a long-run relationship between saving and investment and bidirectional causalities between the variables. Afzal (2007) used annual data from 1960 until 2006 and found a long-run relationship between saving and investment in South Africa. He also found evidence of bidirectional causalities between the variables. Cooray and Sinha (2007) found evidence of fractional cointegration in 12 African countries, including South Africa. Behera (2015), using data over the period 1970-2013, found evidence of cointegration between saving and investment in South Africa although the speed of adjustment to its steady state is low. Konya (2015) found that capital is not perfectly mobile in any of the BRICS countries; however, it is more mobile in South Africa and Russia than in India, Brazil and China. Gil-Alana et al. (2016), using data over the period 1946-2013, also found evidence of fractional cointegration between saving and investment in South Africa.

3. Data and the Model

Annual data on South Africa is obtained from the World Bank for the period 1960-2014. The variables are gross domestic saving and gross domestic investment (expressed as percentages of GDP). In lines with Feldstein and Horioka (1980), the domestic saving-investment correlation is examined by estimating a model of the following form:

$$(1)\quad \left(\frac{I}{Y}\right)_i = a + b\left(\frac{S}{Y}\right)_i + \varepsilon_i$$

The model in (1) shows the effect of domestic saving rate on domestic investment rate. In vector error correction form, with *l* lags and *r* cointegrating vectors, the model is represented as:

$$(2)\quad \Delta Y_t = X + AY_{t-1} + \sum_{i=1}^{l-1} \varphi_i \Delta Y_{t-i} + \mu_t$$

The model in (2) is estimated with a linear trend in the levels of the data and in the following sequence: (i) the DF-GLS unit root test is first performed for the two variables to examine stationarity; (ii) both Akaike Information Criteria (AIC) and Schwartz Bayesian Information Criterion (SBIC) are then used to determine the optimum lag length; (iii) the Johansen cointegration test is performed to identify the maximum rank of the cointegrating matrix; (iv) the error correction model is next estimated for short-run and long-run coefficients; (v) a first order differenced VAR model is estimated in order to examine the existence of short-run causality between domestic saving and investment rates; (vi) the diagnostic tests are performed to examine serial autocorrelation, normality in error distribution and stability of the model.

4. The Results

The results of the DF-GLS unit root test are reported in Table 1. The optimum lag length is selected by the minimum of Modified Akaike Information Criteria (MAIC) and SC (Schwartz Criterion) statistics.

Table 1. Unit Root Test

	Level		
	DF-GLS	Lags	10% critical value
I/Y	-1.41	2	-2.86
S/Y	-1.85	1	-2.89
	First-Difference		
	DF-GLS	Lags	1% critical value
ΔI/Y	-5.34*	1	-3.76
ΔS/Y	-4.88*	1	-3.76

The results indicate that the variables are first-difference stationary. The Johansen cointegration test is performed with two lags selected by AIC and SBIC. The results are reported in Table 2.

Table 2. Johansen Cointegration Test

Maximum Rank	Eigenvalue	Trace Statistic	5% Critical Value
0	-	24.65	15.41
1	0.35	1.36*	3.76
2	0.03	-	-

The model fails to reject the null hypothesis of at least one cointegrating (long-run) relationship. In order to determine the line of causality between the variables, a first-order differenced vector autoregressive model is estimated. AIC selected a model with two lags; thus the Granger causality test is performed with two lags. The results are reported in Table 3.

Table 3. Granger Causality

	ΔI/Y	ΔS/Y
ΔI/Y	-	4.63 (0.09)***
ΔS/Y	4.61 (0.10)***	-

The results indicate short-run causality between domestic saving and investment rates at 10% significance level; thus domestic savings Granger cause domestic investment and vice-versa.

The VECM is estimated with two lags and one rank specification within Johansen (1995) framework; that is, if the maximum rank of the cointegrating matrix is 1, then at least 1 restriction will be imposed when determining the free parameters. The restriction is imposed on domestic investment rate, and the results are reported in Table 4 and Table 5.

Table 4. Short-Run Coefficients

	coefficient	standard error	probability
ECM_{t-1}	-0.19*	0.07	0.01
$\Delta I/Y_{t-1}$	0.59*	0.14	0.00
$\Delta S/Y_{t-1}$	-0.24*	0.09	0.01
constant	-0.25	0.72	0.72

The short-run effect of domestic saving rate on domestic investment rate is negative and significant at 1% significance level. The ECM coefficient is also negative and significant at 1% significance level, indicating rapid adjustment toward long-run equilibrium.

Table 5. Long-Run Coefficients

	coefficient	standard error	probability
I/Y	1.00	-	-
S/Y	-0.96*	0.12	0.00
constant	-2.35	-	-

The normalized cointegrating vector is given by (1, -0.96). When interpreting the normalized cointegrating vector, the sign of the long-run coefficient of S/Y will be reversed. Therefore, the long-run relation between domestic saving and investment rates is given by the equation

$$(3)\ \frac{I}{Y} = 2.35 + 0.96^{*}\frac{S}{Y}$$

The long-run coefficient 0.96 in Table 5 implies that, for every 1% increase in domestic saving (in proportion to GDP), domestic investment (in proportion to GDP) will increase by 0.96%.

South Africa is classified as an upper middle income country by the World Bank, and the long-run coefficient estimates from the cointegration analysis are similar to the findings of Schmidt (2001) and other previous studies, that for middle and high income countries, the domestic saving-investment correlation coefficient falls in the range (-1, 1). The study period 1960-2014 covers more than five decades of important political and economic events in South Africa, such as achieving independence from the UK, apartheid followed by the end of apartheid regime, and liberalisation of the economy since the 1990s. Thus with economic liberalisation and financial deregulation, there was a gradual transition to becoming a more open economy. Despite this transition, the coefficient estimate of the domestic saving rate observed in this study is as high as 0.96. It is close to 1.00 and very similar to the findings of Feldstein and Horioka (1980), that capital is not as mobile as we would expect for an emerging market economy like South Africa. The significant positive coefficient estimate 0.96 along with the bidirectional causalities observed between domestic saving and investment rates

validate the findings of Feldstein and Horioka (1980), that a larger fraction of any increase in domestic savings will be invested domestically. According to Feldstein and Horioka (1980), some of the factors that impede capital mobility are institutional rigidities, a bias towards home investment due to international differences in tax laws, political uncertainty and risks in foreign investment. Some factors for the high long-run saving coefficient could also be the choice of fiscal and monetary policies of the national government, access to domestic credit, and a change in consumption preferences between traded and non-traded goods. Some major global economic events that could affect saving-investment decisions in South Africa could be the Asian financial crisis in 1997, high economic growth in the United States in the 1990s that was followed by severe recession in 2007, and financial crisis in Russia, Iceland and Ireland.

Numerous other factors that could affect the long-run domestic saving-investment correlation coefficient could be the country size (Harberger, 1980), temporary business cycle shocks (Obstfeld, 1986; Baxter & Crucini, 1993), long-run current account targeting (Coakley & Kulasi, 1997), the substitutability between domestic and external savings (Sachsida & Caetano, 2000), financial and trade integration (Blanchard and Giavazzi, 2002), and home bias (Georgopoulos & Hejazi, 2005).

The results of the VECM diagnostic tests for autocorrelation, normality in error distribution and stability are reported in Table 5.

Table 6. VECM Diagnostics

LM	chi-square statistic	degrees of freedom	probability
Lag 1	2.61	4	0.63
Lag 2	3.36	4	0.49
Normality	chi-square statistic	degrees of freedom	probability
Jarque-Bera	0.01	2	0.99
VECM Unit Moduli: 1			

The chi-square statistics for the LM test for autocorrelation, 2.61 and 3.36, are both less than the 5% critical value 7.78; thus, the model fails to reject the null of no serial correlation at each lag. The Jarque-Bera statistic for normality in error distribution, 0.01, is less than the 5% critical value 4.61; the errors are, therefore, normally distributed. Since the VECM does not impose more than one unit moduli, the eigenvalue stability condition is satisfied.

5. Conclusion

This paper has examined the short-run and long-run effects of domestic savings on domestic investment (in proportion to GDP) in South Africa over the period 1960-2014. The results of the DF-GLS unit root test show that both the variables are integrated of order one. The Johansen test for cointegration indicates a long-run relationship between the two variables. The long-run effect of domestic saving rate is significantly positive and close to 1; therefore, in South Africa, domestic saving policies are found to have significant impact on domestic investment for the sample period under study. Granger causality indicates short-run causality from domestic saving rate to domestic investment rate. Some plausible factors for the positive saving-investment relation have been discussed. Based on the results of the cointegration and causal analysis observed in this study, it is expected that domestic saving policies would play a significant role in stimulating domestic investment in South Africa and prevent capital outflow.

South Africa achieved independence from the UK in 1934. Apartheid lasted from 1948 until early 1990s followed by economic liberalisation and financial deregulation. South Africa has had low domestic saving-investment ratios since achieving independence. Exchange control was removed in the mid 1990s and that allowed South Africa to become more integrated with the global economy.

The period 1992-2003 was marked by economic crisis in South Africa. The country experienced net capital outflows and an economic slowdown. The period was marked by fiscal imbalance and current account deficit. As Behera (2015) observed, the economic recovery was led largely by growth in public and private consumption. Exports and imports fell and the stock market was weakened by net capital outflow.

The high long-run coefficient of the domestic saving rate observed in this study indicates that, despite South Africa's transition to a relatively more open economy in recent years, capital is not fully mobile in South Africa. An increase in domestic savings will lead to an increase in domestic investment. As Mngqibisa (2014) observed, in order to maintain a positive domestic saving-investment relationship, it is important for the South African government to implement policies that will make domestic currencies and assets more attractive to the domestic savers. That will prevent net capital outflow. This can be achieved by maintaining a low inflation rate (necessary for maintaining price stability) and preventing excessive fluctuations in the exchange rate and interest rate.

A possible extension of this study could be to re-examine the domestic saving-investment correlation in South Africa with structural breaks in the data over the same sample period, i.e., account for the effects of apartheid, end of apartheid and economic liberalisation. It might also be interesting to include additional variables as potential determinants of domestic investment and also identify the line of causality between the variables for a more robust inference.

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