An examination of the impact of financial deepening on long-run economic growth: An application of a VECM structure to a middle-income country context.

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ABSTRACT: This paper examines the impact of financial deepening on long run economic growth in South Africa over the period 1954-92. Two models are developed using the Johansen VECM structure. The first model investigates whether the financial system has a direct or indirect effect on per capital output via the investment rate. The second model attempts to investigate the possibility of feedback effects between the financial and real sectors. We find that both dimensions of the financial system - financial intermediation and securities - affect economic growth in both models. Furthermore, both models reveal that the financial system has an indirect effect on GDP via the investment rate. Feedback effects are also found to exist between the real and financial sectors. One interpretation of the evidence is that credit rationing is prevalent in South Africa with firms extensively relying on internal finance to meet their financing requirements.

1 Introduction

The emergence of groups of countries experiencing similar growth paths and the increasing divergence between the growth performances of different groups of countries has led to an increased interest in the investigation of the impact of the financial sector on the economic growth process in the international literature.

The literature discussing the association between the financial system[1] and economic growth falls into two distinct categories - financial liberalisation (Levari and Patinkin, 1968) versus financial repression Tobin (1965, 1967).[2] Literature in favour of financial liberalisation argues that the presence of money in an economy enhances economic growth while literature in favour of financial repression believes money to be an obstacle. The source of this division in the literature stems from the manner in which money affects the savings behaviour of agents. The theory that agents hoard savings in the form of money balances and thus reduce the level of savings available for investment in physical capital stock is propagated by the financial repression literature. Literature in favour of financial liberalization argues that money raises the equilibrium growth path of the economy since it represents a *productive* resource.

Recent international theoretical and empirical find a clear link between the financial sector and growth[3] which is found to be both direct and indirect [4] and bi-directional.[5] Evidence establishing the importance of both of the two major institutional components of finance-financial intermediaries and securities markets - has also emerged. They support the argument that a robust financial sector, with minimum financial crises, is essential for growth and poverty reduction, with no empirical support for policies that artificially constrain one in favour of the other.

The possibility of the presence of direct, indirect and/or feedback effects suggest the need for the incorporation of dynamics into any model that estimates the relationship between the financial and real sectors. Neglect of the multiple-equation framework implied by the indirect and feedback mech-

[1] This paper will also use the term *money* to imply the financial system.

[2] These works formed the basis of the subsequent debates surrounding the relationship between financial deepening and economic growth.

[3] See for example, Rousseau and Wachtel (1998).

[4] Indirect link via increases in the investment rate and total factor productivity.

[5] See Jung (1986).

anism, would result in misspecification. Cross sectional growth studies face inherent constraints in realising the full systems estimation. and it is therefore desirable to conduct the study in a time series framework which takes account of the presence of simultaneous relationships in the system. The appropriate method of estimation is thus the Johansen full information maximum likelihood (FIML) vector error correction model approach (VECM).[6] Such a model would contain multiple vectors capturing the direct and indirect effect of the financial sector on real per capita output while also capturing feedback effects (if present).

A further point of interest arises with respect to the developmental trajectory an economy faces. While most prior studies have been conducted for developed countries (in the case of time series studies), or a mix of developed and developing countries (in the case of cross sectional studies), none to our knowledge has addressed the middle-income countries specifically. Yet middle-income countries represent a special test case, capable of shedding light on the nature of the transition from less developed to developed economy status, and the role of the financial system in that transition.

The middle-income country chosen for this paper is South Africa. South Africa has a unique economic and financial structure. Although South Africa represents an emerging market, middle-income developing country with an uneven distribution of wealth, her financial sector resembles one of a high-income country.[7] This imbalance present between South Africa's real and financial sectors with respect to their level of development, places her in an unusual category.

Therefore, this paper provides a number of advances over the previous literature. *First*, estimation will use time series data to develop two models. The first model (*Model I*) will explore only the direct and indirect effects of the financial sector on the real economy while the second model (*Model II)* will augment Model I by considering the possibility of feedback effects between the financial and real sectors. *Second*, the paper will employ the Johansen FIML VECM approach on South African data, allowing us to explore the possibility of multiple relationships between the real and financial sectors.[8] To our knowledge a study exploring this possibility does not exist

[6] See Johansen and Juselius (1990).

[7] See World Bank Report (2000).

[8] Patrick (1966) postulates that the direction of association changes over the course of development and therefore no unvarying relationship may exist between the real and financial sectors over *time*

at present. In this sense therefore, the present paper represents an advance on the debate as it currently stands.

Using South African data from 1954-1992, we analyse the role of the financial system in propagating economic growth. Firstly, we employ the Pesaran, Shin and Smith autoregressive distributed lag (PSS ARDL) approach to determine the direction of association between the two sectors of the economy.[9] We then estimate Model I and Model II. Both models confirm that financial deepening has a positive effect on per capita GDP. Model I finds that both financial intermediation and stock market liquidity indirectly, positively affect per capita GDP via increases in the investment rate. The results from Model II suggest that while stock market liquidity affects per capita output via the investment rate (as in Model I), financial intermediation has *no direct* effect on the real economy. In Model II, liquidity is found to have a stronger effect on per capita GDP than Model I. The possible presence of credit rationing in the South African financial sector may explain the results of Model II.

The paper proceeds in six sections. We begin with a review of the literature on financial development, its effect on growth and report on the findings of international empirical studies. Section 3 provides an outline of the data sources and its characteristics. A presentation of the PSS ARDL methodology and its results occurs in Section 4 and Section 5 summarises the Johansen estimation technique and provides the results for Model I and II. Lastly, we present our concluding remarks.

2 The Theoretical Framework

We begin by discussing the basic foundations of neoclassical growth theory. Consider the Solow-Swan growth model of the economy with a linearly homogenous production function $Y = F(K, L)$,where Y, K and L represent net output, capital and (effective) labour, respectively.[10] In the labour intensive form, $y = f(k)$,where k is the capital-labour ratio. We assume the marginal product of capital to be positive and diminishing, i.e.,$f'(k) > 0$ and $f''(k), 0$ and that the (effective) quantity of labour grows exogenously and at a constant rate per period, $g_{L.}$ The rate of depreciation of capital is assumed to

[9] See Pesaran, Shin and Smith (1996).

[10] See Solow (1956), (1957) and Swan (1956).

be equal to zero.[11] The model concludes that an economy will experience a steady state or equilibrium growth path when:

$$f(k) = (\frac{g_L}{s})k \tag{1}$$

where s denotes the savings rate. The model assumes that all savings in an economy are channelled to investment opportunities and the augmentation of physical capital stock. Given the above equilibrium growth path, we note that the Solow-Swan model implicitly assumes the financial system to be perfectly efficient and money to be neutral. Subsequent literature on growth theory examines the contribution of money to economic growth. Two salient theories have arisen from this literature - financial liberalization vis-à-vis financial repression.

2.1 Role of the Financial System

Literature in favour of financial repression broadly argues that money has a deleterious effect on economic growth while proponents of financial liberalization maintain that money is conducive to growth. The crux of the argument surrounding the impact of the financial system on economic growth focuses on its influence on the savings behaviour of individuals.

2.2 The Case for Financial Repression: The Tobin Model

The Tobin Model (1965, 1967) provides the theoretical justification for financial repression. To demonstrate, we assume there exist real money balances in the economy (M/P),where M represents nominal money balances and P denotes the price level. We also assume no direct storage cost of holding money and assume savings (S) to be proportional to disposable income (Y_d). In this model, Y_d may either be consumed (C) or saved. It is argued that with the introduction of money balances, agents may either allocate savings by investing in physical capital stock[12] (I) or real money balances. They are now able to intemporally transfer value using money by increasing their

[11] The assumption of the rate of capital depreciation (δ) being zero is inconsequential to the steady state since it adds a constant factor (δ) to Equation [1].

[12] As in the case of Solow-Swan Model.

real money balances in the present period which will consequently increase their purchasing power in future time periods. Therefore, there now exist two assets in the economy - physical capital and real money balances. The relative rates of return on capital and money balances are the real rate of interest (which is assumed to equal the marginal product of capital) and the rate of decrease in the price level, respectively.[13]

Therefore,

$$Y_d = C + I + \left[\frac{d\left[\frac{M}{P}\right]}{dt}\right]$$

since

$$Y_d = C + S \tag{2}$$

Given that *gross* output *(Y)* is actual expenditure in the present period *(C + I)* and that the change in real money balances is assumed to be a constant proportion (μ) of the change in real output, the model allows us to obtain the resultant steady state condition for the economy:

$$y = f(k) = \left\{\frac{g_L}{s\left[1 - \mu\,\dot{Y}\left(\frac{1}{2} - 1\right)\right]}\right\} k \tag{3}$$

Since $0 < s < 1$ and $0 \leq \mu \leq 1$, it follows that $\left[1 - \mu\,\dot{Y}\,(1/s - 1)\right] < 1$. Therefore per capita output and capital stock in steady state must be lower than in the classical Solow-Swan Model where money is assumed to be neutral.

The economic intuition behind this result is the following: The existence of money in an economy may encourage agents to hoard savings in the form of money balances. This situation is likely to occur in less developed economies where output is more susceptible to shocks, encouraging individuals to hold precautionary money balances. Tobin (1965, 1967) argues that a smaller proportion of savings is now available for the augmentation of physical capital stock. Therefore, the channelling of savings away from investment in physical capital stock deprives these countries of investment opportunities

[13] See Tobin (1965,1967).

that may accelerate their economic development. Some of the proposed policy responses that combat the allocation of savings to unproductive money balances are interest rate ceilings, high reserve requirements placed on the banking sector and the reduction of the proportion of income held as money (μ) by imposing a tax on money holdings. One such example is an inflation tax that erodes the real value of money. One counter argument to financial repression is that it only applies to *deadweight money* i.e., gold specie and fiat money, while in the modern era, money balances represent *credit money.*[14]

2.3 The Case for Financial Liberalization

The counterargument to Tobin-Keynes derision for the role of money in an economy is developed by Levhari and Patinkin (1968). They argue money to be a productive factor of production. Take a linearly homogenous production function of the form $Y = F(K, L, M/P)$ or $y = f(k, m)$ in the labour intensive form. Inclusion of money into the model in this way assumes that just as production depends on fixed capital, so it depends on *working* capital too. Thus real money balances may be viewed like any other inventory that enters into the production process. With the absence of this medium of exchange, the economy would revert to a barter system with its "double coincidence" constraint. The result would be an inefficient use of resources since money frees labour and capital for the production of commodities by allowing for greater specialization.

Now, the key difference between this model and the Tobin-Keynes model is that here money balances are *not* included separately in the calculation of disposable income since they contribute implicitly to the production of gross output (or gross income). We begin with the equilibrium assumption that $I = S$, where investment is the difference between gross output and consumption.

That is:

$$I = \frac{dK}{dt} = Y - C = sF\left(K, L, \frac{M}{P}\right) - (s-1)\left[\frac{d\left(\frac{M}{P}\right)}{dt}\right] \tag{4}$$

where $s < 1$.

Given that the per capita real money balances (m) equals $\left(\frac{(M/P)}{L}\right)$, $\ln m = \ln(M/P) - \ln L$and

[14]Credit money represents loans between agents in an economy.

$\dot{m} = (\dot{M}/P) - g_L$, the model arrives at the following equilibrium growth path for the economy:

$$f(k,m) = \left(\frac{g_L}{s}\right) k + g_L m \left(\frac{1}{s} - 1\right) \tag{5}$$

where $m^{\bullet} = 0$ and $I/L = g_L k$ in steady state.[15] Since $s < 1$, it follows that $g_L m(1/s - 1) > 0$. Therefore, the equilibrium growth path achieved in the present model is at a higher level of per capita output than both the Solow-Swan and Tobin-Keynes models of the economy. Moreover, where money is not productive, there is no need to use it in production and the economy can revert to a barter system. Should money however serve to improve the efficiency of production, it will allow the economy to realize a higher level of per capita output than in its absence. Hence, financial repression damages one of the *productive* factors of production.

Money in the Tobin-Keynes model reduces investment in physical capital stock[16] as it is assumed to be a *non-productive* asset. In the Levhari-Patinkin Model, money enhances the investment rate (Equation [4]) since it is assumed to represent working capital. Recent empirical studies attest to the findings of the latter model. They indicate that the efficient financial systems of the developed world were a major factor in promoting their economic growth.

2.4 Some Modern Extensions to the Debate

The relationship between the financial structure and economic development has been receiving considerable attention in the growth literature. Figure 1 provides some of the empirical and theoretical results of recent studies conducted on this topic.

The findings broadly argue that financial markets, utilising money, enable agents to shift expenditure from the present into the future in order to obtain higher returns in the long run. They categorize the financial sector into two salient institutions, i.e., financial intermediaries and the securities market. Both these dimensions of the financial market are found to enhance economic

[15] See Levhari and Patinkin (1968).

[16]

$$I = S - \left[\frac{d\left(\frac{M}{P}\right)}{dt}\right]$$

growth. The findings summarized in Figure 1 therefore support the argument in favour of financial liberalization.

Financial intermediaries aid investment and economic growth by mobilising savings. They provide lenders financial instruments of high quality and low risk, and buy the liabilities of borrowers at lower liquidity, lower yield and a larger principal.[17] This enhances the level of savings, investment and thus economic growth. Moreover, since financial markets are faced with information and transaction costs due to the existence of asymmetric information, financial intermediaries reduce the ensuing inefficiencies by acquiring information on the quality of individual loans.[18] In the process of acquiring this information on the quality of the individual risk profile of borrowers, financial intermediaries engage in risk transformation by engaging in portfolio diversification and risk pooling. Therefore, due to the prevalence of asymmetric information in the financial sector, the argument in favour of money as a factor of production in the economy only appears to be viable if a well-functioning financial sector exists.[19]

The international empirical evidence favours not only efficient financial intermediation but also the improved liquidity of the stock market as a source of increased levels of per capita GDP.[20] A liquid stock market encourages investment since it enables investors to cheaply, efficiently and confidently trade ownership of claims.[21] The more easily they are able to vary the composition of their portfolio, the less reluctant agents will be to subscribe to new share issues. Levine (1997) incorporates two measures of liquidity - the turnover and value-added ratios. The former is the ratio of total value of shares traded to stock market capitalization (the value of listed shares on the country's exchanges) of an economy while the latter is the total value of shares traded to GDP.[22]

[17] See Levine (1997).

[18] See King and Levine (1993b)

[19] If financial intermediaries are inefficient credit rationing may occur.

[20] It must be noted that the term *liquidity* is a broader term than when applied to an asset. In the latter it implies to the ease with which an asset ma be converted to cash.

[21] See Levine (1997) and Levine and Zervos (1998).

[22] Levine and Zervos (1998) point out a potential pitfall of the value-traded ratio. If forward-looking stock markets anticipate large corporate profits and therefore higher economic growth, this will boost stock prices and therefore boost value traded. However, in this scenario, the figure for the turnover ratio, which equals value traded divided by market capitalization, does not alter. The turnover does not suffer from this price effect because stock prices enter into the numerator and denominator.

The international empirical evidence claims that the two types of financial systems are *complementary* - those more inclined to the Japanese/German style and those resembling the Anglo-Saxon style. In the Japanese/German style system financial intermediaries play a more prominent role than the stock market in the provision of credit while in the Anglo-Saxon financial system brand the opposite holds. However, the role played by each institution in stimulating growth through the provision of credit may alter as the economy grows. At least one study finds financially more developed economies to ha've a more securities-based financial system since they also tend to have stronger shareholder rights and higher accounting standards.[23]

The international evidence discussed in Figure 1 also indicates that the financial system may have both an indirect and a direct effect on economic growth. The indirect effect is via improvements in the investment rate and total factor productivity.[24] This forms the basis of our preliminary model (Model I) which explores the possibility of the presence of direct and indirect between financial deepening and per capita output growth in South Africa where the indirect effect is borne via the investment rate.

One issue that continues to attract attention is the question of the direction of association between the real and financial sectors. King and Levine (1993a), using post war international data, argue that the level of financial intermediation is a good predictor of economic growth. In such cross sectional studies, however, causal inference is restricted to the observation that economies with greater financial depth at a given point in time, appear to grow faster in subsequent time periods than those with lower initial levels of financial activity. Examining the results of time series studies on the topic may therefore prove to be more useful. One such study conducted by Rousseau and Wachtel (1998) find that finance predicts growth with little evidence of feedback from output to intermediation for five industrialized countries from 1870-1929. Jung (1986), however, finds a bi-directional link between the financial and real variables in post war data. The study is unable to disentangle direct effects from feedback effects. Patrick (1966) postulates that the direction of association changes over the course of development. He argued that the bi-directional relationship present in certain studies may be attributed to financial deepening inducing real innovation-type investment and, "as the process of real growth occurs, the *supply-leading*

[23]For example see Demirgüç-Kunt and Levine(1999).
[24]For example see Neusser and Kugler (1998).

impetus gradually becomes less important, and the *demand-following* financial response becomes dominant."[25] Although the latest studies favour finance leading growth, Patrick's (1966) argument is borne out empirically by Jung (1986). Since South Africa has a relatively well-developed financial market and is a middle-income country, the presence of a "demand-following" financial response may be present (if not dominant) together with a "supply-leading" impetus. Our second model (Model II) therefore attempts to take cognisance of the possibility of feedback effects between the real and financial sectors. The possible presence of direct, indirect and feedback effects between the real and financial sectors emphasizes the necessity for the use of multiple-vector models to account for the possibility of more than one equilibrium relationship in the system.

On the basis of the results of recent empirical studies on the relationship between the economic growth and the financial sector and to ensure an adequate examination of the South African evidence, our study will have to answer four salient questions regarding the impact of financial system on economic growth. They are:

- Does there exist a legitimate association between economic growth and financial deepening? If so, is it positively or negatively related to GDP?
- Is the impact of the financial system on output direct or indirect?
- Which dimension of financial deepening - financial intermediation or liquidity - affects economic growth in South Africa? If both affect per capita output growth, which dimension has a more prominent effect?
- What is the direction of association between the financial and real sectors of the economy?

The direction of association between the real and the financial sectors for South Africa may consist of four possible alternatives. These are:

(a) No association.

(b) Financial deepening affects economic growth.

[25] *Demand-following* implies that the lack of financial growth is due to the lack of demand for financial services (a lack of sufficient income) while *supply-leading* impetus is when the financial sector induces real growth.

(c) Economic growth affects financial deepening.

(d) Economic growth affects financial deepening and visa versa.

To discover which of the four alternatives is present in South Africa, the Pesaran, Shin and Smith (PSS) F-test will employed.

3 The Data

The sample period covers annual data from 1954 to 1992.[26] The dependent variable in the model is real per capita GDP at factor cost ($LNCGDP$).The variables employed by this study to measure the two dimensions of the financial system - financial intermediation and liquidity - are:

- Ratio of total private credit extension to GDP ($CREDIT$):

This series is chosen since we are interested in investigating the share of output that is intermediated through the financial sector.[27] Previous studies have revealed that private credit extension is the most comprehensive indicator of the activity of financial intermediaries.[28] Furthermore, private credit extension is chosen over public credit extension because, unlike the private sector, the public sector has numerous objectives to fulfil when considering an investment project, and positive rates of return may not always be the central goal of a public investment.

Prior to 1960 there was no one composite series that depicted total credit extension to the private sector in South Africa. Therefore a series was constructed by using data from the *Union Statistics for Fifty Years (1910-1960).* The proxy used for total credit extension was the total assets in all financial intermediaries.[29] The resultant series is depicted in Figure 2. One may conclude from the graph that the proportion of total private credit extension to GDP has been steadily rising since 1954.

[26] At the outset, it should be stated that for the Johansen methodology the sample size is small. This may be a shortcoming of the study but an unavoidable one as our measure of liquidity in the economy - total value of shares traded to GDP (CREDIT) - is only available from 1954.

[27] See Levine (1997).

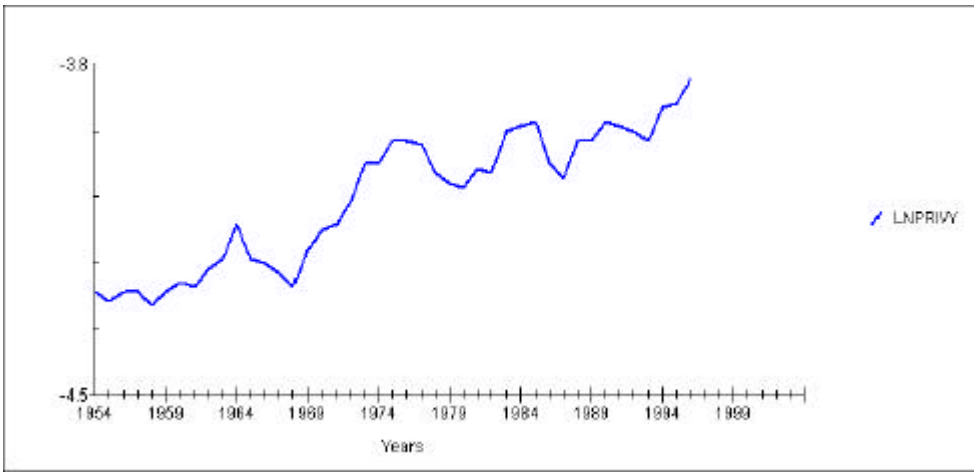
[28] For example see Levine, Loayza and Beck (2000). It therefore surperedes other measures of level of financial intermediation such as th eratio of real money supply (M3)-to-real GDP.

[29] *Assets* to financial intermediaries are synonymous with *liabilities* of the private sector.

Figure 1: International Evidence on the link between the financial and real sectors.

Study	Application and Nature of Study	Finding
Benecivenga & Smith (1991)	Theoretical study	The model predicts that under certain conditions the development of financial intermediation will increase real growth rates.
King & Levine (1993 a,b)	Cross-country analysis using data on 80 countries over the period 1960-89.	Using various measures of the level of financial development, they found all the measures to be robustly correlated with future rates of economic growth, physical capital accumulation and economic efficiency improvements.
Obstfeld (1994)	Theoretical study	Show parameter values that lead to lower savings and growth rates with greater liquidity or risk sharing, respectively. The data are, however, inconsistent with these parameter values. These models have parameter values that are consistent with empirical findings that liquidity is positively associated with growth, and neither liquidity nor international capital market integration is associated with private saving rates.
Benecivenga et al. (1995)	Theoretical study	Strong positive connection between stock market liquidity and faster rates of growth, productivity improvements and capital accumulation.
Levine and Zervos (1996)	Cross sectional sample of 77 countries using three growth rates as dependent variables.	Measures of deepening in financial intermediation and liquidity have a positive and statistically significant relationship to growth in these three dimensions – output growth, investment growth and productivity growth.
Jayaratne & Strahan (1996)	Panel data analysis comprising 50 US states (1972-92)	Find improvements in the quality of bank lending (i.e., banks which channel savings into better projects), not increased volume of bank lending to be responsible for faster economic growth.
Levine (1997)	Cross sectional analysis	Positive link between financial development and economic growth Evidence on structure and the functioning of the financial system is inconclusive.
Rousseau and Wachtel (1998)	Time series study conducted on five industrialized countries (USA, UK, Canada, Norway and Sweden).	Finance predicts growth with little evidence of feedback from output to intermediation.
Rajan and Zingales (1998)	Firm level and industry level analysis for a large sample of countries in a time series framework (1980-90).	Financial development has a substantial influence on economic growth. Financial market imperfections affect investment and growth if financial intermediaries are unable to differentiate between financially viable and unviable investment projects. Existence of a well-developed financial market in a country provides it with a comparative advantage in those industries that are dependent on external finance.
Neusser & Kugler (1998)	Time series study conducted on the manufacturing sector of the OECD countries.	Finance predicts growth. Financial sector development is cointegrated with manufacturing total factor productivity and manufacturing GDP, respectively. Limitation of the study: Financial intermediary development may be a leading indicator but not an underlying cause of economic growth.
Levine & Zervos (1998)	Cross-country analysis (1976-93).	Stock market liquidity and banking development both positively predict growth, capital accumulation and productivity improvements. Stock market size, volatility and international integration are not robustly linked with growth.
Demirguc-Kunt & Maksimovic (1998)	Cross-country study of thirty developed and developing nations.	Active stock market and a well-developed legal system facilitate firm growth.
Levine, Loayza and Beck, (2000)	Cross sectional study and dynamic panel techniques.	Strong, positive relationship between the level of financial intermediary development and long run economic growth is not due to simultaneity bias.
Beck, Levine and Loayza (2000)	Cross sectional study, instrumental variable procedures and dynamic panel techniques.	Financial intermediaries exert a large, positive impact on total factor productivity growth, which feeds through to overall GDP growth. Long run links between financial intermediary development and both physical capital growth and private savings rates are tenuous.

Figure 2: Ratio of Real Private Credit Extension to Real GDP



- Value-added ratio (*LIQUIDITY*):

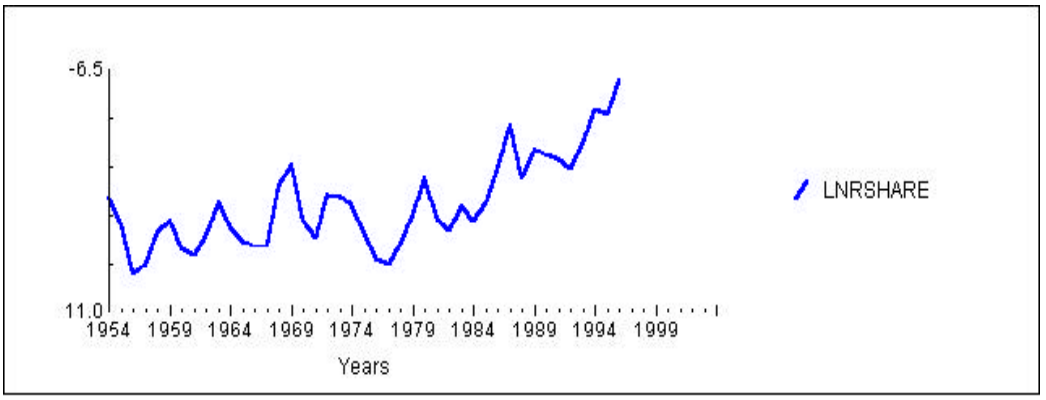
As stated earlier, this series represents the level of stock market liquidity. The variable is constructed using an index (1995=100) of share prices for all classes of shares and an index (1995=100) of the number of shares traded published by the SARB.[30] This index of prices is calculated by obtaining the weighted index numbers of monthly average prices of all ordinary shares quoted on the Johannesburg Stock Exchange (JSE). The weight is based on the market capitalization of each company on the JSE. Figure 3 depicts a rising value of shares traded to GDP over the sample period.

Faced with the need of ensuring an adequate representation of the economy in conjunction with a parsimonious specification to render the Johansen estimation technique manageable, we employ either all or some of the following conditioning explanatory variables in the estimation:

- Our measure of the investment rate *(LNINVRAT)* is restricted to fixed capital stock strictly defined, and is given by net changes in the stock of machinery and capital equipment for South Africa. The investment rate is a crucial component of any growth equation as it captures the

[30] Prices are in real terms.

Figure 3: Total Real Values of Shares Traded to Real GDP



rate of augmentation of physical capital stock throughout the economy. Furthermore, to model the indirect impact of the financial sector on per capita output via the investment rate, an adequately specified investment equation is required. A number of variables affect the investment rate in South Africa. For example, Fedderke (2000) finds it to be adversely affected by uncertainty. The presence of uncertainty is of concern to the investor due to the irreversibility of investment. We proxy for uncertainty using a political instability index *(INSTAB)*.[31] Another determinant of the investment rate is the *expected change* in the rate of return on investment which is an unobservable magnitude. We therefore employ a measure of capacity utilisation, defined as the deviation of actual output from capacity output,[32] such that production in excess of capacity will trigger investment.[33] In the present study we apply a change in the capacity utilisation variable *(DCU)* to approximate for a change in the expected rate of return on investment. We also use a proxy to measure the marginal cost of investment - the real user cost of capital *(UC)*. It includes the sum of the opportunity cost of

[31] See Fedderke, de Kadt and Luiz (2001a).
[32] Calculated by means of a Hodrick-Prescott filter.
[33] Fedderke (2000) finds this to be the case for South Africa.

fixed capital stock (given by the real domestic short term interest rate), the depreciation rate of capital stock and the corporate tax rate. For South Africa, the real user cost of capital does have a negative effect on the investment rate.[34]

- The real domestic short-term interest rate *(INTEREST)* is included as another explanatory variable. Romer (1990) argues that with increases in the interest rate, agents discount future output relative to current output at a higher rate. This results in human capital moving away from the production of knowledge-based goods toward more production of final goods. The consequence is a decline in economic growth.

- Human capital series: Human capital is increasingly acknowledged as a necessary component of economic growth.[35] In this study we employ two human capital variables. One measures white enrolment rates *(WENROL)* and the other measures the proportion of graduates with degrees in math and science *(LNPROPDEG)*. The former is a proxy for the quantity of human capital while the latter is a proxy for the quality of human capital.[36]

- Numerous studies have shown government to have a negative, statistically significant impact on per capita output.[37] Time series evidence on the effect of government on economic growth in South Africa is found to be negative.[38] The series we use to measure the extent of government involvement in the economy is the ratio of real government consumption expenditure to real GDP *(LNGOVGDP)*.

3.1 Univariate Time Series Characteristics of the Data

The univariate time series characteristics of the data are reported in Figure 4. Statistics are the augmented Dickey-Fullers. All the variables are found to be nonstationary,[39] except the variable which measures the expected rate

[34] See Fedderke (2000).

[35] See Hanushek and Kimko (2000) and Mankiw, Romer and Weil (1992).

[36] See Fedderke (2001).

[37] For example see Baldwin and Seghezza (1996), Barro (1990), Barro (1991) and De Gregorio (1993).

[38] Mariotti (2001) establishes the presence of non-linearities in the impact of government consumption expenditure for South Africa.

[39] Integrated of order one ($\sim I(1)$).

of return on investment (*DCU)* which is stationary,[40] and will therefore only enter the model in the dynamics.

We also note that there exists a structural break that affects the investment rate, financial deepening variables and interest rate. This may be attributed to the financial liberalization of 1980 in South Africa. We employ a trend dummy to account for this break (*DT80*). Furthermore, a second break occurs in the investment rate series from 1981-84 due to the gold price boom and this break is accounted for witha shift dummy (*GOLD*). Even though the period in which the two structural breaks take effect overlap, each break is significant as one is a trend dummy *(DT80)* and the other is a shift dummy *(GOLD)*.

As discussed in the Section 2.5, the Pesaran, Shin and Smith (PSS) F-test statistics will be considered to determine the direction of association between financial and real sectors. If there exists an indirect relationship between the financial deepening and per capita output for South Africa, the Johansen FIML VECM's cointegration technique will be applied.[41]

Both techniques of estimation are well acknowledged, so the subsequent subsections will only summarize these techniques.

4 Pesaran, Shin, Smith ARDL Cointegration Technique

4.1 Methodology

Pesaran and Shin(1995a) demonstrate (under certain conditions) that the autoregressive distributed lag (ARDL) models may be used for the estimation of long run relationships. They argue that once the order of the ARDL has been recognized, OLS may be used for the purpose of estimation and identification. The presence of a *unique* long run relationship is crucial for valid estimation and inference. Such inferences on long- and short- run parameters may be made, provided that the ARDL model is correctly augmented to account for contemporaneous correlations between the stochastic terms of the data generating process (DGP) included in the ARDL estimation. Hence

[40] Integrated of order zero ($\sim I(0)$).

[41] The PSS ARDL technique is only applicable if a single, *unique* relationship is present. If an indirect relationship between the variables is found then more than one cointegrating equilibrium relationship may be present.

Variable	~I (0)[1]	~I (1)[1]	Structural breaks[2]
LNCGDP	-2.59	-3.88*	-
LNINVRAT	-1.56	-5.75*	*DT80, GOLD*
LNPRIVY	-0.29	-6.53*	*DT80*
LNRSHARE	0.40	-6.26*	*DT80*
WENROL	-2.59	-5.16*	-
LNPROPDEG	-0.20	-6.40*	-
INSTAB	-3.10	-6.86*-	-
LNGOVGDP	0.80	-6.99*	-
INTEREST	-0.29	-6.55*	*DT80*
UC	-2.01	-5.78*	-
DCU	-6.65*	-	-

Figure 4: Augmented Dickey-Fuller Test Statistics *1. The * denotes rejection of the null of a unit root at the 95% critical value. 2.Provides the dummy variables which attach to the respective variable at a 5% significance level or less.*

ARDL estimation is possible even where explanatory variables are endogenous. Moreover, ARDL remains valid irrespective of the order of integration of the explanatory variables.

The Pesaran Shin and Smith (1996) approach starts by estimating the error correction model given by:

$$y_t = a_0 + \eta t + \sum_{i=1}^{p} \beta_i \Delta y_{t-i} + \sum_{j=1}^{k} \sum_{i=1}^{p} y_{ji} \Delta x_{j.t-i} + \left(\delta_1 y_{t-1} + \sum_{j=1}^{k} \delta_{j+1} x_j \right) + \omega_t \quad (6)$$

and estimating by means of an F-test (or PSS F-test) the significance of a joint zero restriction on the δ s of the error correction model.[42] If the computed statistic exceeds the upper bound, the null of no association can be unambiguously rejected and if it falls below the lower bound, we fail to reject the null of no association. Ambiguity regarding the presence of a cointegrating relationship arises if the statistic is between the two critical values.

[42]The distribution of the F-test is non standard. A lower and an upper critical bound value are presented by Pesaran Shin and Smith (1996).

Assuming an appropriate order of ARDL is selected, if the PSS F-test confirms the existence of only *one* unique cointegrating relationship, i.e., there exists only one *outcome* variable and all other variables are forcing variables, we follow the Pesaran and Shin (1995b) two step strategy in estimating the long- and short-run coefficients on the basis of the selected model.

Suppose that we have an ARDL(p, q) model for which the existence of a long run relationship between yt and x_t has been established. Then the long run relationship between the variables can be established by estimating the ARDL model given below by means of OLS:

$$y_t = \alpha + \beta t + \sum_{i=1}^{p} \gamma_i y_{t-i} + \sum_{i=0}^{q} \delta_i x_{t-i} + \varepsilon_t \tag{7}$$

where the ε_t are assumed to be serially uncorrelated.[43] We then obtain the coefficients of the cointegrating (long run) relationship:

$$y_t = \varsigma + \eta t + \theta x_t + \upsilon_t \tag{8}$$

from:

$$\hat{\varsigma} = \frac{\hat{a}}{1 - \sum_{i=1}^{p} \hat{y}_i}, \hat{\eta} = \frac{\hat{\beta}}{1 - \sum_{i=1}^{p} \hat{y}_i} and\ \hat{\theta} = \frac{\sum_{i=0}^{q} \hat{\delta}}{1 - \sum_{i=1}^{p} \hat{\gamma}_i} \tag{9}$$

Firstly, however, we seek to determine the direction of association between the financial sector and the real sector by analyzing the PSS F-test statistics.

4.2 PSS ARDL Estimation Results

We apply the PSS ARDL technique to obtain the direction of association between real and financial sectors of the economy using the full specification of the model. The results we found were inconclusive. We then conducted the test for different combinations of the financial variables and the investment rate and per capita output. Figure 5 reports the PSS F-statistics.[44] We summarize the direction of association between these variables in Figure

[43] The order of the ARDL is selected on the basis of the Akaike Information Criterion (AIC) to render the error term free of systematic variation.

[44] Both dummy variables - *DT80* and *GOLD*-were included in the analysis.

Variable	F statistics					
LNCGDP (Y)	5.9659*	4.8533	3.9196	-	-	-
LNINVRAT (I)	6.1894*	-	-	6.0557*	3.7412	-
LNRSHARE (S)	-	9.85*	-	6.4831*	-	6.423*
LNPRIVY (P)	-	-	2.7802	-	0.84782	2.5619

Figure 5: PSS F-statistics * *denotes a test statistic above the critical upper bound F-statistic at a 5% significance level.*

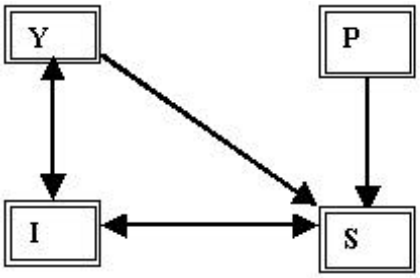


Figure 6: Direction of association between the financial sector and real variables - $x \rightarrow y$ implies y depends on x.

6. We observe that three possible equilibrium relationships *may* coexist - one between the investment rate and per capita GDP, between the investment rate and the total value of shares traded and lastly between per capita GDP, the investment rate, credit extension by intermediaries and the total value of shares traded. This implies that *no* one *single* unique equilibrium relationship exists. We therefore abandon estimation using the PSS ARDL methodology.

The PSS F-test statistics illustrate three issues regarding the relation ship between the real and financial sectors:

1. Financial deepening appears to indirectly affects per capita output through the investment rate,

2. Existence of feedback effects between the real sector and liquidity may be present, and

3. Credit appears to affect the real economy via the total value of shares traded. This may indicate the presence of credit rationing in the South African economy.[45]

These complex relationships between the real and financial sectors indicate that in countries with relatively highly developed financial markets (such as South Africa), the direction of association between economic growth and financial liberalization may indeed be bi-directional. Therefore, the need for identifying the most economically meaningful relationship between these variables by means of plausible economic restrictions (using the Johansen technique) becomes crucial to the estimation process.

5 Johansen VECM Estimation Technique

5.1 Methodology

The Johansen estimation technique employs a vector error-correction (VECM) framework. In the case of variables, we may have r cointegrating relationships, such that $0 \leq r \leq k-1$.[46] This gives us a $k-$dimensional VAR:

$$z_t = A_m z_{t-1} + \cdots\cdots + A_m z_{t-m} + \delta + v_t \tag{10}$$

where m denotes the lag length, δ deterministic terms and ν_t a Gaussian error term. While in general z_t may contain $I(0)$ variables, as long as non-stationary variables are present (as in the present case), we are exclusively restricted to $I(1)$ variables.

Reparametrization provides the VECM specification:

$$\Delta z_t = \sum_{i=1}^{k-1} \Gamma_i \Delta z_{t-i} + \Pi z_{t-k+1} + \delta + v_t \tag{11}$$

The existence of r cointegrating relationships amounts to the hypothesis that:

$$H_1(r) : \Pi = a\beta' \tag{12}$$

[45] World Bank (2000) arrives at a similiar conclusion of the prevalence of credit rationing in South Africa.

[46] See Johansen and Juselius (1990) and Johansen (1991).

where Π is pxp, and a, β are pxr matrices of full rank. Therefore $H_1(r)$ is the hypothesis of reduced rank of Π. Where $r > 1$, issues of identification arise which requires the use of economic restrictions on the loading matrix (a), the matrix representing the short run dynamics, Γ, and/or the cointegrating space, β.[47]

5.1.1 Model I

In Model I (Equation [13]) we override the directions of association between the financial and real sectors indicated by the PSS F-statistics (to some extent) and only test the indirect relationship between the financial sector and real per capita GDP for South Africa.[48] In this case we would expect $r = 2$ representing the per capita GDP and the investment functions. The matrix representing the dynamics of the system will contain, amongst other variables, the measure of the rate of return on investment *(DCU)*.[49]

The signs and zero restrictions on the long run parameters are on the basis of *a priori* economic theory.[50] Both the output function and the investment function are represented. We have no a priori evidence to zero restrict the measures of the level of financial intermediation (P) and liquidity (S) on either cointegrating vector. Thus during the estimation process we test whether these variables have a direct, indirect or both a direct and an indirect, positive impact on per capita output in South Africa.

[47] See Pesaran and Shin (1995a,b), Pesaran, Shin and Smith (1996), Johansen and Juselius (1990) and Wickens (1996), Greenslade, Hall and Henry (2000).

[48] Where $Y_t = LNCGDP_t, I_t = LNINVRAT_t,$
$H_{lt}, = WENROL_t, H_{2t} = LNPROPDEG_t,$
$G_t, = LNGOVGDP_t, r_t = INTEREST_t,$
$U_t = INSTAB_t S_t = LNRSHARE_t$ and $P_t = LNPRIVY_t$.

[49] *DCU~I(0).*

[50] See Section 3.

$$\Pi z_{t-k+1} \begin{bmatrix} a_{11} & a_{12} \\ a_{21} & a_{22} \\ a_{31} & a_{32} \\ a_{41} & a_{42} \\ a_{51} & a_{52} \\ a_{61} & a_{62} \\ a_{71} & a_{72} \\ a_{81} & a_{82} \\ a_{91} & a_{92} \\ a_{101} & a_{102} \end{bmatrix} \begin{bmatrix} 1 & -\beta_{21} & -\beta_{31} & -\beta_{41} & -\beta_{51} & -\beta_{61} & \beta_{71} & 0 & \beta_{91} & 0 \\ 0 & 1 & -\beta_{32} & -\beta_{42} & 0 & 0 & 0 & \beta_{82} & 0 & \beta_{102} \end{bmatrix} \begin{bmatrix}$$

5.1.2 Model II

The second model (Model II - Equation [14]) [51] incorporates the presence of both the indirect and feedback effects in the relationship between the real and financial sectors as suggested by the PSS F-test. We would expect $r = 3$ as there now exists the possibility that while financial deepening indirectly affects per capita output, feedback effects are present from per capita output and investment to liquidity.[52]

Once again the signs and restrictions on the long run parameters are on the basis of *a priori* economic theory.[53] However there exist some differences in the signs of the parameters and restrictions on the parameters between the two models. Although we test once more whether financial intermediation and liquidity has a direct, indirect or both a direct and an indirect, positive impact on per capita output in South Africa, we expect, on the basis of the PSS F-test statistics, β_{31}, β_{41} and β_{42} to equal zero. This implies that the investment function (the equation whose β-parameter for I is one) is affected by only one dimension of the financial system - liquidity. Furthermore, using the results of the PSS F-test statistics, we expect liquidity to be influenced by credit extension in the third equilibrium relationship[54] and the accelerator effect to be present.

We also expect the investment rate in the third cointegrating vector to negatively affect liquidity while in the second vector liquidity positively affects the investment rate. This discrepancy is because as the investment rate increases, per capita output rises (from the first cointegrating relationship), and since liquidity is measured as the total value of shares traded to GDP, the rise in GDP results in this ratio declining.[55]

[51] Excludes the *WENROL* as an explanatory variable. One reason for this is to improve the integrity of the test statistics by increasing the degrees of freedom especially since we have a relatively small sample.

[52] The reason why liquidity and not credit extension was assumed to be the dependent variable of the third cointegrating vector was on the basis of the PSS F-test statistics. The statistics indicate liquidity to be affected by per capita output and the investment rate.

[53] See Section 3.

[54] We expect a positive relationship between liquidity and credit extension since both dimensions of the financial system are expected to enhance growth from previous international empirical findings.

[55] Even though the third equilibrium relationship demonstrates that a rise in per capita GDP does increase liquidity, the rise in liquidity is expected to be less than proportional to the increase in per capita GDP.

$$\Pi z_{t-k+1} = \begin{bmatrix} \alpha_{11} & \alpha_{12} & \alpha_{13} \\ \alpha_{21} & \alpha_{22} & \alpha_{23} \\ \alpha_{31} & \alpha_{32} & \alpha_{33} \\ \alpha_{41} & \alpha_{42} & \alpha_{43} \\ \alpha_{51} & \alpha_{52} & \alpha_{53} \\ \alpha_{61} & \alpha_{62} & \alpha_{63} \\ \alpha_{71} & \alpha_{72} & \alpha_{73} \\ \alpha_{81} & \alpha_{82} & \alpha_{83} \\ \alpha_{91} & \alpha_{92} & \alpha_{93} \end{bmatrix} \begin{bmatrix} 1 & -\beta_{21} & -\beta_{31} & -\beta_{41} & -\beta_{51} & \beta_{61} & 0 & \beta_{71} & 0 \\ -\beta_{12} & 1 & -\beta_{32} & -\beta_{42} & 0 & 0 & \beta_{72} & 0 & \beta_{92} \\ -\beta_{13} & \beta_{23} & 1 & -\beta_{43} & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

While the estimates of the cointegrating vectors indicate the directions of association that maintain long run stationarity in each system, they offer no information about the speed of adjustment of the variables to deviations from their common stochastic trend. The size and sign of each error correction term (ECT), α_{ij} represents the direction and speed of adjustment of the system to its long run equilibrium after a shock.

Furthermore, the error correction model will provide us with the relationship between the rate of change in financial deepening variables and the per capita GDP *growth rate* and describes the behaviour of the economy away from the long run equilibrium growth path.

We first test whether each model is justified with respect to the data by establishing the number of cointegrating vectors for each model.

5.2 Johansen VECM Estimation Results

From above, the first model investigates the presence of a direct and/or indirect relationship between the financial sector and per capita output as suggested by the PSS F-tests.

Model I:

$$\begin{aligned} Y_t &= F(I_t, P_t, S_t, H_{1t}, H_{2t}, G_t, r_t) \\ I_t &= G(Y_t, P_t, S_t, U_t, UC_t) \end{aligned} \tag{15}$$

The PSS F-tests also indicate the possibility of a second model. This model incorporates feedback effects between the liquidity and the real sector as well as an indirect effect from the financial sector to per capita output:

Model II:

$$\begin{aligned} Y_t &= F(I_t, H_{2t}, G_t, r_t) \\ I_t &= G(Y_t, S_t, U_t, UC_t) \\ S_t &= H(Y_t, I_t, P_t) \end{aligned} \tag{16}$$

5.2.1 Johansen maximal and trace eigenvalue statistics

Figure 7 reveals the Johansen maximal eigenvalue test statistics for Model I. We observe the presence of two cointegrating vectors from the maximal eigenvalue statistic while the trace test statistic indicates the existence of

Null	Alternative	Eigenvalue statistic	95% Critical value	Trace statistic	95% Critical value
r = 0	r ≥ 1	106.89*	63.32	343.76*	234.98
r ≤ 1	r ≥ 2	61.13*	57.20	236.87*	194.42
r ≤ 2	r ≥ 3	48.00	51.15	175.74*	157.80
r ≤ 3	r ≥ 4	36.81	45.63	127.74*	124.62
r ≤ 4	r = 5	31.16	39.83	90.94	95.87

Figure 7: Johansen trace and maximal eigenvalue statistics for Model I - * *denotes statistical significance*

Null	Alternative	Eigenvalue statistic	95% Critical value	Trace statistic	95% Critical value
r = 0	r ≥ 1	103.08*	57.20	299.71*	194.42
r ≤ 1	r ≥ 2	57.98*	51.15	196.63*	157.80
r ≤ 2	r ≥ 3	46.60*	45.63	138.66*	124.62
r ≤ 3	r = 4	33.96	39.83	92.05	95.87

Figure 8: Johansen trace and maximal eigenvalue statistics for Model II - * *denotes statistical significance*

four equilibrium relationships. The maximal eigenvalue statistic forms the basis of the formulation of a two-vector model in order to investigate the indirect effect of the financial sector on per capita output.

Using the variables for Model II, which contains only one of series that measures human capital *(LNPROPDEG)*, the test statistics in Figure 8 are analysed. They indicate the possible existence of three equilibrium relationships which may account for indirect and feedback effects between the real and financial sectors. [56]

[56] The Johansen estimation technique for both models is performed with unrestricted intercepts and no trends in the VAR from 1954-92.

5.2.2 Johansen VECM Estimation Results

Model I The two equilibrium relationships estimated by means of the Johansen FIML are given by:

$$\begin{aligned} LNCGDP_t &= 0.24LNINVRAT_t + 3.69WENROL_t + \\ 0.59LNPROPDEG_t & \quad -3.84LNGOVGDP_t - 0.02INTEREST_t \end{aligned} \tag{17}$$

$$\begin{aligned} LNINVRAT_t &= 0.32LNPRIVY_t + 0.15LNRSHARE_t \\ -1.25^{*}10^{-5} & \quad INSTAB_t - 0.01UC_t \end{aligned} \tag{18}$$

The error correction model in Figures 12 and 13 represent the short run dynamics for each equilibrium relationship. The error correction term ($ecm1B_{-1}$) for Equation [17] is -0.01.[57] Equation [18] has an error correction term ($ecm2B_{-1}$) of -0.25.[58] Since both error correction terms are between zero and minus one and statistically significant, the relationships represent stable equilibria. Furthermore, the error correction model illustrated in Figure 12 provides the economic growth model for the economy. Since the equilibria are stable, economic growth is associated with the economy's steady state given by Equation [17]. The relatively small error correction term in the output equation (Equation [17]) of -0.01 could be because of an under specified production function. The specification is however enough to identify a stable, cointegrating vector.

The findings of Fedderke (2000) are supported by the equilibrium relationship [20] in that both uncertainty and the real user cost of capital have a negative effect on the investment rate. The irreversible nature of investment results in uncertainty having a detrimental effect on the rate of investment. Since the real user cost of capital is affected by government policy (tax rate and interest rate), the findings support the theory that imprudent government policy may have an adverse effect on the rate of investment. The negative impact of interest rates on per capita GDP is supported by the Romer (1990) finding that higher interest rates may move human capital away from the production of knowledge-based goods into final good production. The negative impact of government consumption expenditure on per

[57] See Figure 16 in the appendix.
[58] See Figure 17 in the appendix.

capita GDP confirms the findings of Mariotti (2001). Human capital development does have a positive, statistically significant effect on per capita GDP. This conforms to the finding on the importance of human capital in endogenous growth literature.[59] The expected rate of return on investment (DCU), present in the dynamics of the system, is found to be positive as expected. [60]

Our estimation results suggest that the both financial intermediation and liquidity of the stock market has a positive, and *only* an indirect effect on per capita output. Thus we are able to zero restrict both variables in the per capita output equation (Equation [17]). Thus the relationship between financial deepening and per capita GDP is one where the former affects the latter via the investment function (Equation [18]). A percentage increase in credit extension increases the investment rate by 0.32 percent while a percentage increase in liquidity increases the investment rate by 0.15 percent. We conclude that the evidence for South Africa supports the argument in favour of financial deepening rather than financial repression.

The evidence suggests that financial deepening only affects per capita output indirectly which conforms to theory.[61] Financial intermediaries mobilise savings and channel them to investment while improvements in liquidity allow investors to structure their portfolios with greater flexibility, thus increasing the investment rate and, subsequently, output. The increase in per capita output due to a percentage increase in credit extension and liquidity are 0.08 percent and 0.04 percent, respectively.[62] The evidence implies that an increase in private credit extension has a greater effect on per capita output than an improvement in the level of liquidity present in the JSE. Figure 9 illustrates the direction and magnitude of association between the real and financial sector variables.

Hence the conclusions we draw from the findings of Model I are:

1. Financial deepening has a positive indirect effect on per capita GDP,

[59] See Hanushek and Kimko (2000)

[60] See Figures 16 and 17 in the appendix

[61] For example see Levine (1997).

[62]

$$\frac{\partial Y_t}{\partial x_t} = Y_I(I_x) = \frac{\partial Y_t}{\partial I_t} x \frac{\partial I_t}{\partial x_t},$$

where x_t, denotes either dimension of the financial sector, Y_t denotes per capita output and I_t denotes the investment rate.

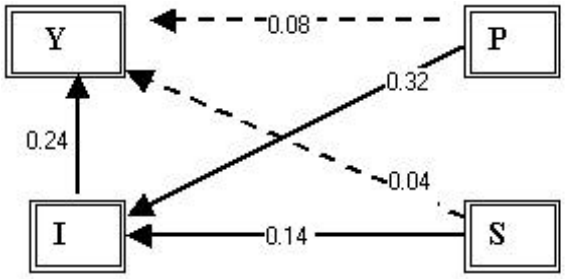


Figure 9: Direction and magnitude of association between real and financial sectors - *The dashed arrows represent calculated impacts and the solid arrows denote the impacts shown by the cointegrating vectors.*

2. The two dimensions of financial deepening are complementary to one another, and

3. For South Africa, financial intermediation plays a more prominent role in augmenting the investment rate and, therefore, per capita output than liquidity. It is therefore plausible to argue that credit extension to the private sector is a greater stimulant of the real economy than enhanced liquidity on the stock exchange for South Africa (for the sample period).

Model II Johansen FIML VECM provides the following for Model II:

$$\begin{aligned} LNCGDP_t &= 1.08LNINVRAT_t + 057LNPROPDEG_t - \\ &\quad 1.83LNGOVGDP_t - 0.03INTEREST_t \end{aligned} \tag{19}$$

$$\begin{aligned} LNINVRAT_t &= 0.21LNCGDP_t + 0.28LNRSHARE_t \\ &\quad -2.591{*}10^{-6}INSTAB_t - 0.01UC_t \end{aligned} \tag{20}$$

$$\begin{aligned} LNRSHARE_t &= 0.83\ LNCGDP_t - 5.92 \\ &\quad LNINVRAT_t + 0.26LNPRIVY_t \end{aligned} \tag{21}$$

The error correction terms for cointegrating vectors [19], [20] and [21], provided by Figures 14, 15 and 16,[63] are -0.04, -0.50 and -0.91, respectively. All three error correction terms are negative and statistically significant. This confirms that equilibrium relationships [19], [20] and [21] are stable.

The signs on the explanatory variables in Equation [19] are similar to those in Equation [17]. In Model II, our *a priori* expectations of the estimation results, on the basis of the PSS F-statistics of the relationship between the financial and sectors, are realised. Equations [19] and [20] confirm the existence of the accelerator effect in South Africa. The investment function is closely related to the one derived in Model I except that the only financial variable that affects the investment rate is liquidity (Equation [20]). A percentage increase in the ratio of total value of shares traded increases the investment rate and per capita output by 0.28 percent and 0.30 percent, respectively. Unlike Model I, credit extension directly, positively affects liquidity. From Equation [21] we observe that a percentage increase in credit extension and per capita GDP increases the ratio of value of shares traded by 0.26 percent and 0.83 percent, respectively. We calculate the effect of a percentage increase in credit extension on per capita GDP and the investment rate to be an increase of 0.08 percent and 0.07 percent, respectively. Thus both Model I and Model II illustrate the positive contribution of both dimensions of the financial sector to economic growth. Therefore, they are not mutually exclusive with regard to economic growth for South Africa. Figure 11 illustrates a flowchart of the various associations between the real and the financial sector for Model II.[64]

We are thus able to disentangle the direct effects of liquidity on the real economy from the feedback effects.[65] In spite of this, the relative effect of increases in liquidity vis-à-vis credit extension on per capita GDP may be exaggerated.[66] The variable measuring liquidity (ratio of value of shares traded to GDP) may be responding to a larger set of variables than specified in the model,[67] leaving open the possibility of misspecification in the third

[63] See appendix

[64] The flowchart is a copy of the PSS F-test results (Figure 4) with the inclusion of the results of Equations [23],[24] and [25].

[65] Jung (1986) finds similar feedback effects.

[66] Note that financial intermediation has the same, positive effect on per capita GDP in both Models I and II.

[67] One such variable is political instability. However, we do not include this variable in the models.

Source of Working Capital	Number of firms grouped according to the proportion of their total working capital from each source.		
	1-50%	51-99%	100%
Retained/internal earnings	14	28	25
Loan from a local South African Bank	22	17	9
Loan from a foreign bank	1	0	0
Loan from a partner or parent establishment	4	8	8
Shares issued on the stock exchange	0	2	2
Other	4	1	1

Figure 10: Sources of working capital in South Africa (1998-99) - *Source: "Constraints to Growth and Employment in South Africa"- World Bank Report (2000).*

cointegrating vector.

Although one measure of the financial system (liquidity) affects per capita output indirectly via the investment rate as in Model I, credit extension has *no direct* influence on the real sector. One possible explanation for the absence of a *direct* association between financial intermediation and the real sector may be attributed to the presence of credit rationing within the South African economy. Firms may find it difficult to source working capital from financial intermediaries for investment projects. Indeed this is borne out by the evidence gathered by a recent World Bank Report on the constraints to growth in South Africa.[68] This Report finds most South African firms use internal sources of finance for investment purposes. Figure 10 illustrates the number of firms using different sources of working capital classed according to the proportion of their total working capital for the period 1998-99. It shows *only* nine firms finance 100 percent of their investment capital requirements using loans from local banks and *only* two firms finance 100 percent of their investment capital by share issues. This supports the argument of the prevalence of credit rationing within the South African economy.

[68] See World Bank Report (2000).

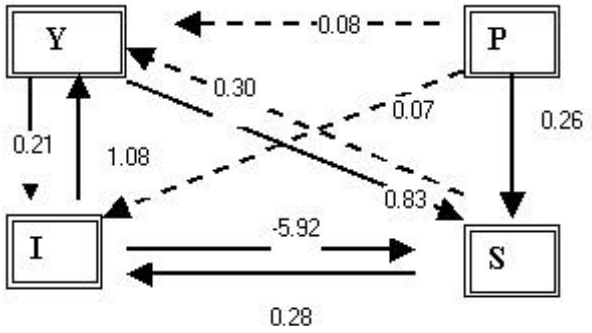


Figure 11: Direction and magnitude of association between real and financial sectors.

6 Conclusion

The financial system can no longer be regarded as a passive channel that allocates scarce resources to the most efficient uses. Today most economists agree that the financial system is essential for development.[69] They argue that a more efficient financial system leads to higher growth and reduce the likelihood and severity of crises. Both Model I and Model II estimated in this paper support the conclusion that financial deepening, i.e. improved financial intermediation and increased liquidity, in the economy promotes economic growth in South Africa. Furthermore, both models find that neither financial intermediation nor the level of stock market liquidity directly affects per capita GDP. Both these dimensions of the financial system are found to indirectly affect per capita output via the investment rate. Furthermore, the findings of Model I illustrate credit extension to have a greater effect on the investment rate when compared with liquidity, Model II reverses the strength of this impact.

The major difference between the structures of the two models is that Model II accounts for the presence of feedback effects between per capita output and liquidity. Therefore, the presence or absence of feedback effects is absolutely crucial in determining which aspect of the financial system has a more dominant effect on the real economy. The results in Model II introduce the possibility of the presence of credit rationing in the South African

[69] For example see Levine (1997), Levine and Zervos (1998) and Levine, Loaysa and Beck (2000).

economy. Thus Model II supports the findings of the World Bank study regarding the existence of credit rationing in South African financial markets. However, the potential exaggerated effect of liquidity on per capita output and the investment rate may point to the need for further studies to render more precise the nature of the interaction between the real and financial sectors of the economy.

Even though a time series framework is the correct approach to investigate the link between financial deepening and economic growth, larger data sets than are available to this study will be a prerequisite for the conduct of such studies. Moreover, including total factor productivity rather than the investment rate to capture the contribution of finance to long-term growth for South Africa may improve the robustness of the study. The presence of feedback effects also needs to be investigated further with the inclusion of additional variables that may affect the liquidity measure, to allow for the full exploration of the dynamics of the system.

Data Sources

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Figure 12: Error Correction model for *LNCGDP*

```
Ordinary Least Squares Estimation
*******************************************************************************
 Dependent variable is DLNCGDP
 37 observations used for estimation from 1956 to 1992
*******************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 INPT                      -.18922            .070785            -2.6732[.012]
 DLNCGDP(-1)                .71431***            .11863             6.0214[.000]
 DLNINVRAT(-1)            -.019797*           .011480            -1.7244[.095]
 DCU                        1.0140***           .045420            22.3250[.000]
 DCU(-1)                   -.71923***            .13351            -5.3871[.000]
 ECM1B(-1)                -.010177**           .0037623            -2.7050[.011]
 ECM2B(-1)               -.0059675           .0046541            -1.2822[.210]
*******************************************************************************
 R-Squared                        .97352   R-Bar-Squared                    .96822
 S.E. of Regression            .0045499   F-stat.    F(  6,  30) 183.8193[.000]
 Mean of Dependent Variable    .0076035   S.D. of Dependent Variable     .025524
 Residual Sum of Squares       .6210E-3   Equation Log-likelihood       150.9074
 Akaike Info. Criterion        143.9074   Schwarz Bayesian Criterion    138.2692
 DW-statistic                    2.1125   Durbin's h-statistic     -.49423[.621]
*******************************************************************************
                              Diagnostic Tests
*******************************************************************************
*    Test Statistics  *        LM Version        *         F Version         *
*******************************************************************************
* A:Serial Correlation*CHSQ(   1)=   .20203[.653]*F(   1,  29)=   .15922[.693]*
* B:Functional Form   *CHSQ(   1)=   .61609[.433]*F(   1,  29)=   .49106[.489]*
* C:Normality         *CHSQ(   2)=   .56943[.752]*       Not applicable       *
* D:Heteroscedasticity*CHSQ(   1)=   .22006[.639]*F(   1,  35)=   .20941[.650]*
*******************************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
```

*** denotes coefficients that are significant at the 1% level.
** denotes coefficients that are significant at the 5% level.
* denotes coefficients that are significant at the 10% level.

Figure 13: Error Correction model for *LNINVRAT*

```
Ordinary Least Squares Estimations
*******************************************************************************
 Dependent variable is DLNINVRAT
 37 observations used for estimation from 1956 to 1992
*******************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 INPT                       1.7750            1.2059              1.4719[.151]
 DLNINVRAT(-1)              .18765            .13116              1.4307[.163]
 DUC(-1)                  .0096184*          .0045410              2.1181[.043]
 DCU(-1)                    1.4122*            .53273              2.6509[.013]
 DT80                     -.016372*          .0074775             -2.1894[.036]
 ECM1B(-1)                 .072494           .057599              1.2586[.218]
 ECM2B(-1)                -.25256**           .074545             -3.3880[.002]
*******************************************************************************
 R-Squared                        .55199   R-Bar-Squared                   .46239
 S.E. of Regression              .051117   F-stat.    F(  6,  30)    6.1606[.000]
 Mean of Dependent Variable -.0042616   S.D. of Dependent Variable     .069717
 Residual Sum of Squares         .078389   Equation Log-likelihood        61.4035
 Akaike Info. Criterion          54.4035   Schwarz Bayesian Criterion     48.7653
 DW-statistic                     1.7161   Durbin's h-statistic      1.4322[.152]
*******************************************************************************
                                Diagnostic Tests
*******************************************************************************
*    Test Statistics  *        LM Version        *         F Version         *
*******************************************************************************
* A:Serial Correlation*CHSQ(   1)=   .65311[.419]*F(   1,  29)=   .52110[.476]*
* B:Functional Form   *CHSQ(   1)=   .85367[.356]*F(   1,  29)=   .68490[.415]*
* C:Normality         *CHSQ(   2)=   1.2348[.539]*       Not applicable       *
* D:Heteroscedasticity*CHSQ(   1)= .5397E-5[.998]*F(   1,  35)= .5106E-5[.998]*
*******************************************************************
   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
```

** denotes coefficients that are significant at the 1% level.

* denotes coefficients that are significant at the 5% level.

Figure 14: Error Correction model for *LNCGDP*

```
Ordinary Least Squares Estimation
*******************************************************************************
 Dependent variable is DLNCGDP
 37 observations used for estimation from 1956 to 1992
*******************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 INPT                     -.49020            .050280            -9.7494[.000]
DLNCGDP(-1)               .11526**            .040286             2.8611[.008]
DLNCGDP(-2)              .068692*            .039876             1.7226[.096]
DLNCGDP(-3)              .083629*            .038689             2.1616[.039]
DCU                      1.1194**            .049262            22.7234[.000]
ECMY(-1)                -.036404**           .0047038            -7.7393[.000]
ECMI(-1)                -.0099720*           .0039813            -2.5047[.018]
ECMS(-1)                -.0088046**           .8657E-3           -10.1710[.000]
*******************************************************************************
 R-Squared                      .97556   R-Bar-Squared                    .96966
 S.E. of Regression           .0044460   F-stat.    F(  7,  29)  165.3491[.000]
 Mean of Dependent Variable   .0076035   S.D. of Dependent Variable     .025524
 Residual Sum of Squares      .5733E-3   Equation Log-likelihood       152.3887
 Akaike Info. Criterion       144.3887   Schwarz Bayesian Criterion    137.9450
 DW-statistic                   1.8471
*******************************************************************************
                              Diagnostic Tests
*******************************************************************************
*    Test Statistics  *        LM Version        *         F Version         *
*******************************************************************************
* A:Serial Correlation*CHSQ(   1)=   .11514[.734]*F(   1,  28)=  .087406[.770]*
* B:Functional Form   *CHSQ(   1)=  .099955[.752]*F(   1,  28)=  .075847[.785]*
* C:Normality         *CHSQ(   2)=   2.2743[.321]*       Not applicable       *
* D:Heteroscedasticity*CHSQ(   1)=   1.0164[.313]*F(   1,  35)=   .98860[.327]*

   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
```

** denotes coefficients that are significant at the 1% level.
* denotes coefficients that are significant at the 5% level.

Figure 15: Error Correction model for *LNINVRAT*

```
Ordinary Least Squares Estimation
*******************************************************************************
 Dependent variable is DLNINVRAT
 35 observations used for estimation from 1958 to 1992
*******************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 INPT                       1.6724            1.2993              1.2872[.211]
 DLNCGDP(-1)               -3.7681*           1.3692             -2.7520[.012]
 DLNRSHARE(-1)            -.089383**          .022561             -3.9618[.001]
 DLNRSHARE(-2)            -.058181**          .018115             -3.2117[.004]
 DLNRSHARE(-3)            -.015426            .015781            -.97747[.339]
 DUC(-1)                  .018785**           .0037647             4.9897[.000]
 DCU                       .95639*            .44316              2.1581[.042]
 DCU(-1)                   4.8579**           1.5040              3.2301[.004]
 GOLD                     .093003**           .022010             4.2255[.000]
 DT80                    -.034440**           .0079874           -4.3118[.000]
 ECMY(-1)                  .044181            .10591             .41716[.681]
 ECMI(-1)                -.49939**            .077972            -6.4046[.000]
 ECMS(-1)                -.0046895            .012966            -.36169[.721]
*******************************************************************************
 R-Squared                        .84527   R-Bar-Squared                  .76087
 S.E. of Regression              .034535   F-stat.    F( 12,  22)   10.0151[.000]
 Mean of Dependent Variable -.0026423   S.D. of Dependent Variable     .070623
 Residual Sum of Squares         .026239   Equation Log-likelihood        76.2645
 Akaike Info. Criterion          63.2645   Schwarz Bayesian Criterion     53.1547
 DW-statistic                     2.5443
*******************************************************************************
                              Diagnostic Tests
*******************************************************************************
*    Test Statistics  *        LM Version        *         F Version         *
*******************************************************************************
* A:Serial Correlation*CHSQ(   1)=   4.2893[.038]*F(   1,  21)=   2.9330[.102]*
* B:Functional Form   *CHSQ(   1)=   2.8467[.092]*F(   1,  21)=   1.8592[.187]*
* C:Normality         *CHSQ(   2)=   .41711[.812]*      Not applicable       *
* D:Heteroscedasticity*CHSQ(   1)=   .26159[.609]*F(   1,  33)=   .24850[.621]*

   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
```

** denotes coefficients that are significant at the 1% level.

* denotes coefficients that are significant at the 5% level.

Figure 16: Error Correction model for *LNRSHARE*

```
Ordinary Least Squares Estimation
*******************************************************************************
 Dependent variable is DLNRSHARE
 37 observations used for estimation from 1956 to 1992
*******************************************************************************
 Regressor              Coefficient       Standard Error         T-Ratio[Prob]
 INPT                     -27.8681            16.5501             -1.6839[.112]
 DLNCGDP(-1)                .26179             6.0157             .043517[.966]
 DLNCGDP(-2)                .18181             5.5177             .032950[.974]
 DLNCGDP(-3)               -1.6368             5.4953             -.29786[.770]
 DLNCGDP(-4)               -6.9973             5.1533             -1.3578[.193]
 DLNCGDP(-5)                3.8770             5.4772              .70784[.489]
 DLNCGDP(-6)               -2.5671             5.8736             -.43706[.668]
 DLNINVRAT(-1)              2.4860             2.5489              .97531[.344]
 DLNINVRAT(-2)              4.2745*             2.2902             1.8664[.080]
 DLNINVRAT(-3)              2.8894             2.0857             1.3854[.185]
 DLNINVRAT(-4)              2.9186             2.2357             1.3054[.210]
 DLNINVRAT(-5)              5.8604 **            2.0763             2.8225[.012]
 DLNINVRAT(-6)              3.2726             1.9436             1.6838[.112]
 DLNINVRAT(-7)              1.5046             1.6517             .91096[.376]
 DLNINVRAT(-8)              2.6912             1.6360             1.6450[.119]
 DLNRSHARE(-1)              .54578**             .24295             2.2465[.039]
 GOLD                       .58630*             .31139             1.8829[.078]
 DT80                       .25921*             .12261             2.1141[.051]
 ECMY(-1)                  -1.1635             1.3477             -.86332[.401]
 ECMI(-1)                   1.1568             .70706             1.6360[.121]
 ECMS(-1)                  -.90701***             .22963            -3.9499[.001]
*******************************************************************************
 R-Squared                        .70470   R-Bar-Squared                    .33557
 S.E. of Regression               .43464   F-stat.     F( 20,  16)     1.9091[.097]
 Mean of Dependent Variable      .027814   S.D. of Dependent Variable      .53322
 Residual Sum of Squares          3.0226   Equation Log-likelihood        -6.1617
 Akaike Info. Criterion         -27.1617   Schwarz Bayesian Criterion     -44.0763
 DW-statistic                     1.9134   Durbin's h-statistic            *NONE*
*******************************************************************************
                                Diagnostic Tests
*******************************************************************************
*    Test Statistics  *        LM Version        *         F Version         *
*******************************************************************************
* A:Serial Correlation*CHSQ(   1)=  .069743[.792]*F(   1,  15)=  .028328[.869]*
* B:Functional Form   *CHSQ(   1)=   .60183[.438]*F(   1,  15)=   .24802[.626]*
* C:Normality         *CHSQ(   2)=   .80259[.669]*      Not applicable        *
* D:Heteroscedasticity*CHSQ(   1)=  .076233[.782]*F(   1,  35)=  .072261[.790]*

   A:Lagrange multiplier test of residual serial correlation
   B:Ramsey's RESET test using the square of the fitted values
   C:Based on a test of skewness and kurtosis of residuals
   D:Based on the regression of squared residuals on squared fitted values
```

*** denotes coefficients that are significant at the 1% level.
** denotes coefficients that are significant at the 5% level.
* denotes coefficients that are significant at the 10% level.