Savings and Financial Sector Development: Panel Cointegration Evidence from Africa

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Abstract

The present paper uses panel integration and cointegration tests for a dynamic heterogeneous panel of 17 African countries to examine the impact of financial sector development on private savings. We used three different measures of financial sector development to capture the variety of channels through which financial structure can affect the domestic economy. The empirical results obtained vary considerably among countries in the panel, thus highlighting the importance of using different measures of financial sector development rather than a single indicator. The evidence is rather inconclusive, although in most of the countries in the sample a positive relationship between financial sector development and private savings seems to hold. The empirical analysis also suggests that a change in government savings is offset by an opposite change in private savings in most of the countries in the panel, thus confirming the Ricardian equivalence hypothesis. Liquidity constraints do not seem to play a vital role in most of the African countries in the group, since the relevant coefficient is negative and significant in only a small group of countries.

Keywords: Financial Sector Development, Private Savings, Panel Cointegration Tests, Africa

JEL Classification: E21, E44, C22

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1. Introduction

Recent years have witnessed an increasing interest in the role of the financial sector in economic development.[1] In the aftermath of the financial crises of 1997-98, it is becoming increasingly clear that a sound understanding of the interaction between financial structure and domestic and international finance is vital for economic growth and long-term prosperity. Contrary, however, to a vast and increasing literature on financial sector development and growth, little has been written on the important relationship between financial structure and savings mobilisation.[2] The above clearly suggests for further research on this important issue.[3]

Quite suprisingly, the significant nexus of financial sector reforms and savings mobilisatiion has not been explored empirically for the African region so far, given the overall low savings rates of many African economies in recent years and the fact that a substantial number of African countries have undertaken a series of financial reforms recently to improve economic performance.[4]

Most African countries often lack an appropriate financial sector, which provides incentives for individuals to save and acts as an efficient intermediary to convert these savings into credit for borrowers. The financial liberalisation experience of many African economies in recent years, although towards the right direction in many cases, seems to suggest that changing the financial structure of an economy is a complicated process which assumes a deep understanding of the entire set of interactions between financial

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[1] See Arestis and Demetriades (1997) for an excellent assessment of the literature.
[2] Among the few exemptions are the study by Bandiera, Caprio, Honohan and Schiantarelli (2000), which, by using data on a selected group developing countries has concluded that financial sector development does not necessarily raise private saving, and Kelly and Mavrotas (2001), which shows a rather strong positive impact of different financial sector development indicators on private savings in India over the period 1972-97.
[3] For a critical review of the relevant literature see Mavrotas and Kelly (2001a).
[4] A recent study on Zambia has shown that financial sector reforms were unable to boost savings due, *inter alia*, to poor design and inappropriate regulation (Maimbo and Mavrotas, 2001).

sector reforms and the economy. At the same time, the recent experience of the Asian financial crisis clearly suggests that whilst financial liberalisation may be desirable, the process must be correctly regulated (Stiglitz, 1999; Brownbridge and Kirkpatrick, 1999).

In view of the above, the present paper contributes to the relevant literature in four important respects:

(i) On the modelling front, we use a new version of the extended life-cycle model of savings behaviour proposed by Modigliani (1990) and extended by Japelli and Pagano (1994) to allow for liquidity constraints; this is now further modified to include various measures of financial sector development as determinants of private savings.

(ii) We focus on a selected group of 17 African countries (purely determined on the basis of data availability) to shed light, on the relationship between financial sector development and savings mobilisation in the African region for the first time in the relevant literature.

(iii) Our database, recently constructed by the World Bank and described in detail in Loayza et al. (1998), is a clear departure from existing databases on savings by representing the largest macroeconomic data set on saving and related variables; the data has been subject to extensive consistency checks which resulted in a high quality savings data as opposed to the case of conventional data sets which suffer from serious limitations and constraints. Furthermore, we use three different measures of financial sector development to assess the potential differential impact of each measure on private savings behaviour in the above group of African countries.

(iv) Finally, on the econometric front, we employ an innovative panel cointegration approach, never used before in empirical studies of savings behaviour for developing countries, so that reliable evidence is derived. Our econometric methodology, based on recently developed panel cointegration and integration tests, allows, *inter alia*, for complete heterogeneity in dynamic panel data analysis

- an issue that has been neglected in cross-section and panel data studies of savings behaviour of both developing and industrial countries.[5]

The rest of the paper is organised as follows: in section 2 we discuss modelling issues and section 3 deals with data issues. Section 4 focuses on the measurement of financial sector development, followed by section 5, which discusses econometric methodology issues and empirical findings. The last section concludes the paper.

2. The Model

The paper uses the modified life-cycle model of saving behaviour proposed by Modigliani (1990) and extended by Japelli and Pagano (1994) for estimation. This model was used by Sarantis and Stewart (2000) to test saving behaviour in OECD countries. We modify this model further by including various measures of financial sector development as determinants of private savings behaviour.

The model takes the form:

$$PSAV_t = a_0 + a_1PCRED_t + a_2GOVSAV_t + a_3RGPDI_t + a_4FSDx_t + e_t$$

Where $PSAV_t$ is the private saving rate, $PCRED_t$ denotes the liquidity constraint, $GOVSAV_t$ is the rate of government saving, $RGPDI_t$ measures real gross personal disposable income per capita, and $FSDx_t$ is an appropriate measure of financial sector development, as discussed below.

The inclusion of the liquidity constraint variable in the above model reflects the criticism of the extended Modigliani's model (1990) by Japelli and Pagano (1994) as being unable to address issues of liquidity constraints in savings behaviour under conditions of

[5] The striking exemption is a recent study by Sarantis and Stewart (2000) which uses panel cointegration tests to derive the long-run determinants of savings in OECD countries.

imperfect capital markets. The rationale in this case is that the easing of liquidity constraints may discourage private savings. The government saving variable in the model captures Ricardian equivalence effects along the lines of Barro (1974) and Feldstein (1982), who suggest that, under Ricardian equivalence, public debt issues are macroeconomically indistinguishable from tax increases, and thus a change in public saving should be offset by an equal and opposite change in private saving. We also employ gross private disposable income to capture traditional income effects as being more appropriate than using gross national disposable income or GDP, both of which have been used extensively in the past, as we are examining the private saving rate, rather than national or aggregate savings.

3. Data Issues

Data for private saving is expressed as a percentage of gross private disposable income (GPDI). Private saving is calculated on the basis of the consolidated central government (CCG) definition of the public sector; this data is obtained from the World Bank saving database (see Loayza *et al.* (1998) for further details).[6] Calculation of GPDI was performed as outlined below.

RGPDI refers to the log of real GPDI per capita. This is calculated by subtracting CCG saving and CCG consumption from gross national disposable income (GNDI). These data are all obtained from the World Bank saving database. Real GPDI is obtained by dividing GPDI by CPI .To get RGPDI per capita, real GPDI is divided by population. Finally, to express this in a common currency (US$) real GPDI per capita is divided by the World Bank Atlas conversion factor.

[6] The CCG definition of the public sector used in the World Bank Database comprises budgetary central government plus extra budgetary central government plus social security agencies. Essentially, CCG is equivalent to general government minus local and regional governments. The CCG definition defines public savings as inclusive of all net transfers from abroad. In view of the above, private savings = gross national saving - public sector saving. Note that as the CCG definition is used, private saving will include the saving of both local government and public enterprises (World Bank Database, 1998).

Government saving (GOVSAV) is taken from the World Bank saving database. This is CCG saving, consistent with private saving above, and is expressed as a percentage of GNDI.

The private credit (PCRED) data refers to financial resources provided to the private sector- such as through loans, purchases of non-equity securities, and trade credits and other accounts receivable - that establish a claim for repayment. This measure is expressed as a percentage of GDP. The private credit data comes from the World Bank's *World Development Indicators* (1999).

The span of the data varies. When undertaking panel integration testing, the longest available time series for each variable for each country was used. The longest data span was 1960-1997 (38 years); the shortest was 15 years. For the panel cointegration tests, the span was determined by the shortest span for an individual variable in a particular country. Given that data on private saving was only available to 1994 (see World Bank database), this provided an upper limit. Generally, most countries had data from 1972 to 1994; however, in some cases this was reduced.

There are a number of potential determinants of private saving that have not been included in the above specification, such as the rate of interest, and demographic variables such as the dependency ratio. The exclusion of some determinants is unavoidable due to the degrees of freedom available, on account of the short time series availability. The decision regarding which variables to include was based on a trade-off of the hypotheses we wished to test. Some may regard the exclusion of the rate of interest as remiss; however, the ambiguity of the results obtained by other authors in the past (see, for example, Bandiera *et al.*, 2000) led us to exclude this variable. Similarly, the decision to exclude demographic variables was taken because these are generally treated as weakly exogenous, and so are of limited interest to our study.

4. Measures of Financial Sector Development

Measuring financial sector development is a rather complicated procedure since there are no concrete definitions as to what financial development is. As argued quite rightly by Bandiera *et al.* (2000) an ideal index of financial sector development should attempt to measure both the various aspects of the deregulatory and the institution-building process in financial sector development. However, measuring the above aspects is a difficult if not impossible task.[7] A number of measures of financial sector development have been suggested in the recent past. In the present paper we use measures suggested by Beck, Demirguc-Kunt and Levine (1999), given in their database on *Financial Development and Structure*. The database unites a wide variety of indicators that measure <u>size</u>, <u>activity</u> and <u>efficiency</u> of financial intermediaries and markets. Some selectivity has been exercised in choosing which measures to employ since some are more applicable than others for the particular group of countries we are examining.

A general finding is that central banks lose relative importance as one moves from low to high-income countries, and other financial institutions gain relative importance. Thus a measure of relative size of financial intermediaries is a useful indicator of development. Beck *et al.* (1999) disaggregate total financial assets into central bank assets, deposit money bank assets and other financial institutions assets, and propose 3 measures, each of which presents the respective asset class as a percentage of total financial assets. Given the lack of disaggregated data for some of the countries under consideration, we use a broader measure that measures the relative importance of deposit money banks relative to central banks, a measure that has been used as a measure of financial development by,

[7] See Bandiera et al. (2000) for an excellent discussion of previous studies tried to quantify the effects of financial sector development on savings.

inter alia, King and Levine (1993 a,b), and Levine, Loayaza and Beck (1998). This measure is denoted FSD1.

Absolute size of the financial sector to GDP is a useful measure of financial depth, which represents the level of development of the financial sector. We use a measure of absolute size based on liabilities, as proposed by Beck *et al.* (1999). This is liquid liabilities to GDP, which equals currency plus demand and interest bearing liabilities of banks and other financial intermediaries divided by GDP. It is the broadest available indicator of financial intermediation, as it includes all three of the financial sectors outlined above. This measure is denoted FSD2.

The above measures do not distinguish whether the claims of financial intermediaries are on the public sector or the private sector. It is useful to have an indicator that concentrates on claims on the private sector. Beck *et al.* (1999) propose a measure of private credit by deposit money banks and other financial institutions to GDP. This measure isolates credit issued to the private sector, and concentrates on credit issued by intermediaries other than the central bank. This measure has been used by Levine, Loayaza and Beck (1998) and Beck, Levine and Loayaza (1999). We denote this measure FSD3.

5. Econometric Methodology and Empirical Findings

This paper employs the most recent panel integration and cointegration tests for a group of 17 African countries to look at the long run determinants of private saving. The countries used in the panel are selected entirely on the basis of data availability. These countries are listed in **Appendix 1**.

Use of panel unit root and cointegration tests enable one to determine the long run structure of savings in a dynamic setting, avoiding the well known problems involved in using static cointegration testing, and the problems of the sensitivity of cointegration tests to low-powered stationarity tests involved in time series analysis. Most importantly, these innovative panel data techniques allow for heterogeneity in coefficients and dynamics across countries, and allow one to test directly for the existence of long run equilibrium saving functions.

5.1 Testing for Stationarity in Panel Data

As with standard cointegration tests it is important to know the stationarity properties of the data to ensure that incorrect inferences are not made. Testing for stationarity in panel data differs somewhat from conducting unit root tests in standard individual time series; these differences will be discussed in what follows.

The simplest panel unit root tests can be attributed to Levin and Lin (1992,1993). These tests allow for fixed effects and unit specific time trends in addition to common time trends. Incorporating a degree of heterogeneity in this manner is important as the coefficient of the lagged dependent variable is restricted to be homogenous across all units of the panel. The authors prescribe the use of augmented Dickey Fuller (ADF) tests to test for unit roots.

In this paper we follow the methodology of Sarantis and Stewart (2000) by using two recently developed tests for dynamic heterogenous panels. Im, Pesaran and Shin (1997) modify Levin and Lin's framework by allowing for heterogeneity of the coefficient on the lagged dependent variable. The authors propose the use of a group-mean Lagrange Multiplier (LM) statistic to test for the null that the coefficient on the lagged dependent variable is equal to zero across all members of the panel. Standard ADF regressions are estimated and the LM statistic is computed. In simplistic terms, one calculates a statistic termed the t-bar statistic by the authors; this is based on the average of the augmented Dickey Fuller t-statistics for individual countries. The authors have computed critical values for the components of their tests by using stochastic simulations, and they show that the t-bar statistic converges to a standard normal distribution as the number of countries and the number of observations tends to infinity.

In view of the above, the statistic is calculated as follows:

$$\psi = \{\sqrt{\mathrm{N}[\mathrm{t}_i(p) - a_i]}\}/\sqrt{b_i}$$

Where t is the average of the N individual country ADF t-statistics, with lag orders *p*, and a_i and b_i are respectively the expected mean and variance of the individual country ADF statistics, t_i.[8]

The statistic ψ converges to a standard normal distribution as T, N ~ ∞, so the hypothesis of a unit root can be rejected or not depending on comparing the value obtained to the standard normal critical values.

Maddala and Wu (1999) focus on the shortcomings of both the Levin and Lin (1992, 1993) and Im *et al.* (1997) frameworks. In particular, they focus on the difficulties inherent in the Im *et al.* tests. These are discussed in Banerjee (1999); they include the assumption that the panels are balanced, which is frequently not the case in practice. Also, in common with Levin and Lin, the critical values are sensitive to the choice of lag lengths in the ADF regressions. Maddala and Wu (1999) proposed a more straightforward, non- parametric unit root test.

This is given by:

$$\lambda = -2\sum \ln(\pi_i)$$

[8] The mean and variance are computed by Im *et al.* (1997) for different values of T and *p* by stochastic simulations via 50,000 replications.

where π_i are the probabilities of the test statistic for a unit root in unit i, asymptotic values of which were calculated using the program apvals.exe, and λ is distributed as χ^2 with 2N degrees of freedom. Maddala and Wu show that their test dominates that of Im *et al.* (1997) in that it has smaller size distortions and comparable power, and is robust to statistic choice, lag length in the ADF regressions, and varying time dimensions for each cross sectional unit.

Full results of the Im *et al.* (1997) and Maddala and Wu (1999) stationarity tests are contained in **Tables 1** and **2** respectively. With the exception of PSAV, the variables are found to be I(1). In the case of PSAV, the Im *et al.* test rejects the null at both the 5% and 1% level, suggesting that the PSAV series is stationary. The Maddala and Wu test rejects the null at the 5% level, but not at the 1% level. Given the low power of such stationarity tests, the evidence that PSAV may be stationary is not a cause for concern.

5.2 Testing for Cointegration in Heterogenous Panels

We use the Pedroni (1999) framework to test for cointegration. This formulation allows one to investigate heterogeneous panels, in which heterogeneous slope coefficients, fixed effects and individual specific deterministic trends are permitted. In its most simple form, this consists of taking no cointegration as the null hypothesis and using the residuals derived from the panel analogue of an Engle and Granger (1987) static regression to construct the test statistic and tabulate the distributions.

The cointegration regression is given by:

$$\mathrm{S_{it}} = \alpha_i + \delta_{\mathrm{i}}\mathrm{t} + \beta_{1i} X_{1it} + ... + \beta_{mi} X_{mit} + \varepsilon_{it} \qquad \mathrm{t} = 1 \ldots \mathrm{T}, \mathrm{i} = 1 \ldots \mathrm{N}.$$

Based on the cointegration residuals, Pedroni develops seven panel cointegration statistics. The discussion and mathematical exposition of these statistics is contained in

Pedroni (1999), table 1. The asymptotic distributions of these panel cointegration statistics are derived in Pedroni (1997). Under an appropriate standardization, based on the moments of the vector of Brownian motion functionals, these statistics are distributed as standard normal. The standardization is given by:

$$\kappa = [\mathrm{k}_{NT} - \mu\sqrt{\mathrm{N}}]/\sqrt{\mathrm{v}}$$

Pedroni (1999) gives critical values for μ and *v* with and without intercepts and deterministic trends. The small sample size and power properties of all seven tests are discussed in Pedroni (1997). He finds that size distortions are minor, and power is high for all statistics when the time span is long. For shorter panels, the evidence is more varied. However, in the presence of a conflict in the evidence provided by each of the statistics, Pedroni shows that the *group-adf statistic* and *panel-adf statistic* generally perform best.

The results of the Pedroni tests are given in **Table 3**. In the case of the system including FSD1 as the measure of financial sector development, the null of no cointegration was rejected by the *panel pp statistic*, the *panel adf statistic* and the *group adf statistic*. It was not rejected by the other test statistics. When FSD2 was substituted for FSD1, the same results were obtained. When FSD3 was used, the null of no cointegration was also rejected by the *group pp statistic*. Given the above discussion concerning the size distortions and power properties, we can conclude that the evidence indicates the existence of cointegrating relationships.

Of course, while it is interesting to know that there are one or more long run relationships in the non-stationary data, it is of more interest to discover the nature of these relationships. Larsson *et al.* (1998) develop a test based on Johansen's (1988) multivariate cointegration framework. Given N countries with time dimension T, and a set of p I(1) variables, the heterogeneous vector error-correction model is given by:

$$\Delta \mathrm{Y}_{it} = \Pi_{\mathrm{i}} Y_{i,t-1} + \sum \Gamma_{\mathrm{ik}} \Delta Y_{i,t-k} + \varepsilon_{it} \qquad i = 1,\ldots,N$$

Where Y is a *px1* vector of variables and the long run matrix Π is of order *pxp*. This equation is estimated for each country N, using the maximum likelihood method, and the trace statistic is calculated. The null hypothesis to be tested is that all N countries have the same number of cointegrating vectors (r) among the *p* variables. In other words, H_0: $\text{rank}(\Pi) = r_i < r$, against the alternative hypothesis, H_1: $\text{rank}(\Pi) = p$ for all $i = 1..N$.

The panel cointegration rank trace test statistic, Y, is obtained by calculating the average of the N individual trace statistics, LR, and then standardizing it as follows:

$$Y = \left\{\sqrt{N}\left[LR - E(Z)\right]\right\} / \sqrt{Var(Z)}$$

Where E(Z) and Var(Z) are, respectively, the mean and variance of the asymptotic trace statistic, obtained from Larsson (1998). This converges to a normal distribution N(0,1). The results of the Larsson tests are given in **Tables 4-6** for FSD1-FSD3 respectively. The tests indicate the existence of two cointegrating vectors in each case. From theory, it seems likely that there will be a long run relationship between PCRED and RGPDI. We impose this relationship in addition to a relationship in which PSAV is normalized: Wald tests indicate that this is reasonable. We do not report details of the cointegrating vector between PCRED and RGPDI as this is not of relevance to the study.

5.3 Deriving the Long-run Equations

The next step is to examine the long-run determinants of private saving rates in individual countries. These are obtained from a Johansen cointegration framework[9], and are given in

[9] Sarantis and Stewart (2000) use the Saikkonen (1991) and Stock and Watson (1993) methods, which include leads and lags, in addition to the Johansen method to obtain long run saving equations. Such methods have been shown to be preferable where estimation of a single cointegrating vector is of concern (Maddala and Kim (1998)). However, we do not use these methods as our model contains two cointegrating vectors.

Tables 7-9, for FSD1-3 respectively. On account of the data span limitations discussed above, we are restricted to using one lag, as including more lags leads to determination problems. However, as we are using annual data, this is not unreasonable.

The results, reported in **Tables 7-9,** seem to suggest a considerable variation among the countries included in the panel in terms of the factors affecting private savings. When the financial sector development indicator FSD1 is used (**Table 7**) the credit variable has the expected negative sign in only 6 countries in the sample and is significant in only 3 of them, thus, not supporting Jappelli and Pagano's view regarding the role of liquidity constraints in savings behaviour. Turning to the Ricardian equivalence hypothesis, the results seem to suggest a confirmation of the theory in 10 countries in the panel, although significant coefficients are reported in only 6 of them. For the remaining countries in the group the government savings coefficient has a positive sign. The income variable, contrary to what expected, has a negative sign in the majority of the countries included in the group and the expected positive impact in only 5 of them. Of crucial importance in the present study is the impact of financial sector development, as measured by FSD1 in this case, on private savings. The results vary considerably. In 7 countries the effect is positive and significant in 6 of them. For the remaining countries the parameter is negative, thus indicating a discouraging effect on private savings.

Do the results change if we measure financial sector development in a different way? In view of the results reported in **Tables 8** and **9** (FSD2 and FSD3 respectively) the answer is 'partly, Yes'. More precisely, the results in **Table 8** show that when a different financial sector development indicator is used, in this case FSD2, financial sector development has a clear positive impact on private savings in 11 countries in the sample (and significant in 10 of them), thus confirming *a priori* expectations regarding the role of financial sector in mobilising savings. The use of FSD2 indicator does not seem to affect the conclusions related to Ricardian equivalence. Indeed, in 11 countries in the panel, the parameter is positive and significant (except in one case), suggesting that the Ricardian equivalence hypothesis holds. Furthermore, the easing of liquidity constraints does not seem to discourage private savings in most of the countries included in the sample. Finally, income effects are positive in only 5 countries in the panel. In the case of financial sector development indicator FSD3 employed in the present study (see **Table 9**), the results are again mixed concerning the potential impact of finance on savings. Financial sector development measured in terms of the activity of financial intermediaries encourages private savings in 10 countries in the panel (though significant in only 6 of them). For the rest the coefficient is negative. There is also substantial variation in the case of government savings variable, given that now the Ricardian equivalence hypothesis holds in only 7 countries. The liquidity constraints effect as hypothesised by Jappelli and Pagano (1994) is rejected in 12 countries and is confirmed in only 5 cases (though significant in 4). Disposable income affects savings in a positive way in only 5 countries, thus casting doubts on the expected positive impact of this variable on private savings for the majority of countries included in the panel.

6. Concluding Remarks

The present paper used panel integration and cointegration tests for a dynamic heterogeneous panel of 17 African countries to examine the impact of financial sector development on private savings. We used three different measures of financial sector development to capture the variety of channels through which financial structure can affect the domestic economy. The empirical results obtained vary considerably among countries in the panel, thus highlighting the importance of using different measures of financial sector development rather than a single indicator. The evidence is rather inconclusive, although in most of the countries in the sample a positive relationship between financial sector development and private savings seems to hold. The empirical analysis seems also to suggest that a change in government savings is offset by an opposite change in private savings in most of the countries in the panel, thus confirming the Ricardian equivalence hypothesis. Liquidity constraints do not seem to play a vital role in most of the African countries in the group, since the relevant coefficient is negative and significant in only a small group of countries. Finally, *a priori* expectations regarding the role of disposable income for private savings are not confirmed. The above empirical findings regarding the impact of financial sector variables on private savings are in line with results reported in Bandiera *et al.* (2000), though for a different small group of countries and not in the context of panel cointegration analysis.

What are the tentative policy implications related to the above empirical findings? The inconclusive evidence associated with the present study seems to suggest that the financial reforms undertaken in many African countries in recent years and the existing financial structure in many of them are not appropriate to mobilise private savings, which is of crucial importance for achieving sustainable development and poverty-reducing growth.[10] Designing and implementing financial reforms cannot guarantee savings mobilisation in case policy makers are agnostic about the variety of channels and mechanisms through which financial structure can affect savings and other key macroeconomic variables. This raises significant policy issues. As a recent study has put it:

"… the importance of getting the big financial policy decisions right has thus emerged as one of the central development challenges of the new century. However, the controversy stirred up by the recent financial crises has pointed to the weaknesses of doctrinaire policy views on how this is to be achieved (my emphasis; World Bank, 2001, *Finance for Growth: Policy Choices in a Volatile World*, OUP, p.1).

Along these lines, strengthening the weak financial systems in the African region seems to be of crucial significance, since advanced financial structures can contribute to long-term prosperity. Improving the overall macroeconomic stability, the regulation and supervision of local banks as well as the regulatory environment for micro-finance institutions seem to be appropriate policy directions along with encouraging the provision of savings facilities to micro, small and medium sized enterprises (Brownbridge and Kirkpatrick, 1999; Maimbo and Mavrotas, 2001).

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[10] Clearly, causality issues in the saving-growth relationship are of relevance here. See Mavrotas and Kelly (2001b) for a discussion and new empirical evidence within the context of an econometric approach based on the Toda-Yamamoto test.

References

Arestis, P. and P. Demetriades (1997), "Financial Development and Economic Growth: Assessing the Evidence", **Economic Journal**, vol. 107 pp. 783-99.

Bandiera, O., G. Caprio, P. Honohan, and F. Schiantarelli (2000), "Does financial reform raise or reduce saving?", **The Review of Economics and Statistics**, 82(2).

Banerjee, A (1999), "Panel data unit roots and cointegration: an overview", **Oxford Bulletin of Economics and Statistics**, Special Issue, November 61.

Barro, R. (1974), "Are Government Bonds Net Wealth?", **Journal of Political Economy**, vol.82, pp.1095-1118.

Beck, T., R. Levine, and N. Loyaza (1999), "Finance and the sources of growth", **World Bank Policy Review Working Paper** no. 2057.

Beck, T., Demirguc-Kunt, A. and R. Levine (1999), "A new database on financial development and structure", **World Bank Policy Research Paper No.2146**.

Brownbridge, M. and Kirkpatrick, C. (1999), "Financial sector regulation: lessons of the Asia Crisis", **Development Policy Review**, vol.17, No.3.

Engle, R. and C. Granger (1987), "Cointegration and error correction: representation, estimation and testing", **Econometrica** 55.

Feldstein, M. (1982), "Government Deficits and Aggregate Demand", **Journal of Monetary Economics**, vol.9, pp.1-20.

Im, K., H. Pesaran, and Y. Shin (1997), "Testing for unit roots in heterogeneous panels", University of Cambridge, mimeo.

Jappelli, T. and M. Pagano (1994), "Saving, Growth and Liquidity Constraints", **Quarterly Journal of Economics**, vol. CIX, No.436.

Johansen, S. 1988. "Statistical analysis of cointegration vectors", **Journal of Economic Dynamics and Control** 12.

Kelly, R. and G. Mavrotas (2001), "*On the Determinants of Savings in India: Is there any role for the Financial Sector?*, paper presented at the International Conference on Development and Business Finance: Policy and Experience in Developing Countries, IDPM, University of Manchester, 5-6 April 2001.

King, R., and R. Levine (1993a), "Finance, entrepreneurship and growth – theory and evidence", **Journal of Monetary Economics** 32 (3).

King, R., and R. Levine (1993b), "Finance and growth – Schumpeter might be right", **Quarterly Journal of Economics** 108.

Larsson, R., J. Lyhagen, and M. Lothgren (1998), "Likelihood-based cointegration tests in heterogeneous panels", Working paper 250, Stockholm School of Economics.

Levin, A. and C. Lin (1993), "Unit root tests in panel data: asymptotic and finite sample properties", University of California, San Diego discussion paper.

Levine, R., N. Loyaza, and T. Beck (1999), " Financial intermediation and growth: causality and causes", **World Bank Policy Review Working Paper** no. 2059.

Loayza, N., H. Lopez, K. Schmidt-Hebbel and L. Serven (1998), "The world saving database", World Bank, Washington DC.

Maddala, G., and I. Kim, (1998), "Unit Roots, Cointegration and Structural Change", **Cambridge University Press**, Cambridge.

Maddala, G., and S. Wu (1999), "A comparative study of unit root tests with panel data and a new simple test", **Oxford Bulletin of Economics and Statistics**, Special Issue, November 61.

Maimbo, S. and G. Mavrotas (2001), *Savings Mobilisation and Financial Sector Development in Zambia*, paper presented at the International Conference on *Development and Business Finance: Policy and Experience in Developing Countries*, IDPM, University of Manchester, 5-6 April 2001.

Mavrotas, G. and R. Kelly (2001a), "Savings Mobilisation and Financial Sector Development: The Nexus", **Savings and Development**, Vol.XXV, No.1.

Mavrotas, G. and R. Kelly (2001b), "Old Wine in New Bottles: Testing Causality between Savings and Growth", **The Manchester School**, Vol.69.

Modigliani, F. (1990), "Recent development in saving rates: a life cycle perspective", Frisch Lecture, Sixth World Congress of the Econometric Society, Barcelona, Spain.

Pedroni, P. (1997), "Panel cointegration: asymptotic and finite sample properties of pooled time series with an application to the PPP hypothesis: new results", Working paper, Indiana University.

Pedroni, P. (1999), "Critical values for cointegration tests in heterogeneous panels with multiple regressors", **Oxford Bulletin of Economics and Statistics**, Special Issue, November, 61.

Sarantis, N. and C. Stewart (2000), "Saving behaviour in OECD countries: evidence from panel cointegration tests", paper presented at the Money, Macro and Finance Research Group Annual Conference, South Bank University, London, September 2000.

Stiglitz, J. (1999), "Responding to Economic Crises: Policy Alternatives for Equitable Recovery and Development", **The Manchester School**, Vol.67, No.5.

World Bank (2001), *Finance for Growth: Policy Choices in a Volatile World*, Oxford University Press.

Appendix 1: Countries included in the study

Botswana
Republic of Congo
Cote d'Ivoire
Egypt
Gabon
Gambia
Ghana
Kenya
Lesotho
Madagascar
Morocco
Niger
Rwanda
Senegal
Sierra Leone
South Africa
Swaziland.

<u>Table 1:</u> Im, Pesaran and Shin (1997) test for stationarity

Im et al Panel Unit Root tests	PSAV	PCRED	GOVSAV	RGPDI	FSD1	FSD2	FSD3
Botswana	-1.840	-3.422	-1.656	-0.814	na	-1.320	-2.497
Congo Rep	-2.643	39.010	-1.662	-1.428	-2.404	-1.928	-1.971
Cote d'Ivoire	-1.664	-1.301	-1.615	-2.508	-0.768	-2.785	-1.554
Egypt	-2.336	-1.567	-1.053	-2.877	-1.078	-0.898	-0.265
Gabon	-2.548	-2.143	-1.240	-2.699	-2.127	-2.551	-2.480
Gambia	-2.566	-1.259	-1.728	-1.633	-2.046	-2.429	-1.649
Ghana	-2.979	-1.864	-1.121	-1.600	-3.096	-1.646	-1.644
Kenya	-3.135	-2.281	-1.541	1.981	-1.647	-1.197	-0.796
Lesotho	-1.305	0.252	-2.765	-2.639	-1.073	-0.903	-1.184
Madagascar	-2.228	-2.068	-1.825	-1.352	-1.621	-3.608	-0.366
Morocco	-1.904	-1.598	-1.272	-1.366	-1.945	0.870	-2.055
Niger	-2.497	-1.316	-0.372	-2.403	-1.466	-1.688	-0.824
Rwanda	-1.640	-1.948	-1.284	-2.199	-1.710	-1.769	-1.437
Senegal	-1.449	-1.231	-2.602	-2.353	-0.967	-2.221	-1.690
Sierra Leone	-0.412	-1.028	-2.525	0.967	-0.599	-0.986	-0.814
South Africa	-2.155	2.289	-1.513	-1.815	-2.218	-1.454	-1.460
Swaziland	-2.523	-1.798	-1.839	-3.203	-1.884	-1.106	-2.874
t-bar statistic	**-2.493**	**11.477**	**-0.893**	**-0.557**	**-0.631**	**-0.467**	**0.000**

Note: The critical values in all cases are –1.645 (5%) and –2.326 (1%); the sample period for all cases is 1972-1997.

<u>Table 2:</u> Maddala and Wu Panel Unit Root Test.

Madalla et al Panel Unit Root tests	PSAV	PCRED	GOVSAV	RGPDI	FSD1	FSD2	FSD3
Botswana	0.361	0.010	0.454	0.815	na	0.620	0.116
Congo Rep	0.084	0.999	0.451	0.569	0.141	0.319	0.299
Cote d'Ivoire	0.450	0.629	0.475	0.114	0.828	0.060	0.507
Egypt	0.161	0.500	0.733	0.048	0.724	0.789	0.930
Gabon	0.104	0.228	0.656	0.074	0.234	0.104	0.120
Gambia	0.100	0.648	0.417	0.466	0.267	0.134	0.458
Ghana	0.037	0.349	0.707	0.484	0.027	0.459	0.460
Kenya	0.024	0.178	0.513	0.999	0.459	0.675	0.820
Lesotho	0.627	0.975	0.063	0.085	0.726	0.787	0.680
Madagascar	0.196	0.258	0.368	0.605	0.472	0.006	0.916
Morocco	0.330	0.485	0.642	0.599	0.311	0.993	0.263
Niger	0.116	0.622	0.915	0.141	0.550	0.437	0.812
Rwanda	0.462	0.310	0.637	0.207	0.426	0.396	0.564
Senegal	0.559	0.660	0.093	0.155	0.765	0.199	0.436
Sierra Leone	0.908	0.743	0.110	0.994	0.871	0.758	0.815
South Africa	0.223	0.999	0.527	0.373	0.200	0.556	0.553
Swaziland	0.110	0.382	0.361	0.020	0.340	0.713	0.049
Test Statistic	**56.437**	**31.731**	**31.889**	**47.727**	**32.851**	**40.229**	**30.441**

Note: The test statistic is distributed as Chi squared, with 2N (34) degrees of freedom. The asymptotic π values were calculated using the program apvals.exe obtained from James MacKinnon’s website (www.econ.queensu. ca/pub/faculty/mackinnon/jbes).

<u>Table 3:</u> Pedroni Test Results

Pedroni Panel Cointegration Test	FSD1	FSD2	FSD3	CV
Panel v statistic	-1.052	-1.050	0.911	1.64
Panel p statistic	1.020	0.907	-0.161	-1.64
Panel pp statistic	-1.921	-1.747	-5.681	-1.64
Panel adf statistic	-2.589	-1.694	-6.243	-1.64
Group p statistic	2.999	3.270	1.544	-1.64
Group pp statistic	-1.479	-0.869	-7.061	-1.64
Group adf statistic	-2.020	-1.813	-8.124	-1.64

Notes:

1. The cointegration tests were undertaken with different measures of financial sector development, indicated by FSD1, FSD2 and FSD3.

2. Panel v is a nonparametric variance ratio statistic. *Panel p* and *panel pp* are analogous to the non-parametric Phillips-Perron *p* and *t* statistics respectively. *Panel adf* is a parametric statistic based on the augmented Dickey-Fuller ADF statistic. *Group p* is analogous to the Phillips-Perron *p* statistic. *Group pp* and *group adf* are analogous to the Phillips-Perron *t* statistic and the augmented Dickey-Fuller ADF statistic respectively.

3.The formulae for calculating these statistics can be found in Pedroni (1999) Table 1.

<u>Table 4:</u> Larsson et al (1998) Panel Cointegration Test, FSD1

FSD1	**r=0**	**r=1**	**r=2**	**r=3**	**r=4**	**r**
Congo Rep	176.40	18.97	5.16	1.99	0.46	**1**
Cote d'Ivoire	65.14	35.03	19.41	6.90	0.02	**1**
Egypt	54.30	23.79	10.73	3.75	0.24	**0**
Gabon	69.06	25.99	8.65	3.41	0.03	**1**
Gambia	51.35	25.32	10.13	4.41	1.01	**0**
Ghana	46.81	26.32	13.11	4.16	0.20	**0**
Kenya	59.15	26.67	12.92	5.17	1.02	**0**
Lesotho	56.32	28.85	8.49	2.01	0.01	**0**
Madagascar	64.70	34.69	12.72	3.83	0.74	**1**
Morocco	65.01	31.99	16.61	5.22	0.31	**1**
Niger	83.77	46.23	19.34	7.36	1.02	**2**
Rwanda	46.65	26.85	10.10	5.05	1.05	**0**
Senegal	91.43	45.35	20.63	9.94	0.41	**2**
Sierra Leone	59.50	37.29	19.28	7.61	0.19	**1**
South Africa	92.46	38.29	14.58	5.09	1.89	**1**
Swaziland	87.15	46.80	20.04	9.28	0.08	**2**
Avg(Tr)	73.08	32.40	13.87			
E(Z)	44.41	27.74	14.90			
Var(Z)	71.20	44.31	25.80			
Statistic	**14.01**	**2.89**	**-0.84**			

Notes:
1. Avg(Tr) is the average of the trace statistics for the individual countries.
2. E(Z) is the mean of the asymptotic trace statistic obtained from Larsson (1998).
3. Var(Z) is the variance of the asymptotic trace statistic obtained from Larsson (1998).
4. The statistic is normally distributed, and so the critical values are 1.645 (5%) and 2.326 (1%).
5. On account of a lack of FSD1 data, there is no result for Botswana included in the above table.

<u>Table 5:</u> Larsson et al (1998) Panel Cointegration Test, FSD2

FSD2	**r=0**	**r=1**	**r=2**	**r=3**	**r=4**	**r**
Botswana	77.55	34.49	15.29	5.04	1.05	**1**
Congo Rep	177.20	22.48	5.82	1.66	0.31	**1**
Cote d'Ivoire	63.36	38.13	19.36	3.55	1.06	**1**
Egypt	87.33	44.40	18.52	5.55	0.00	**2**
Gabon	77.86	35.24	17.70	3.81	0.38	**1**
Gambia	53.95	22.22	8.39	2.30	0.13	**0**
Ghana	74.79	33.28	18.06	8.17	0.40	**1**
Kenya	68.03	29.89	15.34	4.81	0.29	**1**
Madagascar	55.20	28.05	13.42	4.19	0.90	**0**
Morocco	71.87	34.65	19.24	6.46	0.30	**1**
Niger	54.07	28.83	15.73	5.49	0.86	**0**
Rwanda	49.40	24.50	11.62	5.39	0.17	**0**
Senegal	59.60	24.47	11.69	2.55	0.02	**1**
Sierra Leone	63.26	37.64	21.23	10.18	1.70	**1**
South Africa	100.00	46.97	23.41	6.41	0.21	**2**
Swaziland	92.44	52.16	19.15	4.22	1.11	**2**
Avg(Tr)	76.62	33.59	15.87			
E(Z)	44.41	27.74	14.90			
Var(Z)	71.20	44.31	25.80			
Statistic	**15.74**	**3.62**	**0.79**			

Notes:
1. Avg(Tr) is the average of the trace statistics for the individual countries.
2. E(Z) is the mean of the asymptotic trace statistic obtained from Larsson (1998).
3. Var(Z) is the variance of the asymptotic trace statistic obtained from Larsson (1998).
4. The statistic is normally distributed, and so the critical values are 1.645 (5%) and 2.326 (1%).
5. On account of a lack of FSD2 data, there is no result for Lesotho included in the above table.

Table 6: Larsson et al (1998) Panel Cointegration Test, FSD3

FSD3	r=0	r=1	r=2	r=3	r=4	r
Botswana	95.78	53.66	27.15	5.92	1.54	**3**
Congo Rep	163.50	21.89	3.63	1.13	0.14	**1**
Cote d'Ivoire	77.56	32.35	16.26	7.47	2.63	**1**
Egypt	88.31	38.21	15.40	6.37	0.21	**1**
Gabon	82.51	34.15	12.39	1.32	0.04	**1**
Gambia	83.85	42.17	12.78	3.22	0.10	**2**
Ghana	106.90	42.17	16.24	4.17	0.22	**2**
Kenya	59.37	33.70	18.91	8.02	2.52	**1**
Lesotho	79.51	42.06	17.57	3.02	0.19	**2**
Madagascar	66.83	37.95	12.83	3.18	1.18	**1**
Morocco	64.25	32.48	16.08	7.41	0.30	**1**
Niger	76.04	35.21	13.99	3.29	0.80	**1**
Rwanda	96.88	34.89	17.16	8.01	1.13	**1**
Senegal	86.43	34.91	16.48	2.37	0.17	**1**
Sierra Leone	76.25	47.28	24.03	7.69	2.28	**2**
South Africa	74.94	27.24	21.61	8.61	0.93	**1**
Swaziland	67.35	39.99	19.71	8.67	0.37	**2**
Avg(Tr)	85.07	37.08	16.60			
E(Z)	44.41	27.74	14.90			
Var(Z)	71.20	44.31	25.80			
Statistic	**19.87**	**5.78**	**1.38**			

Notes:
1. Avg(Tr) is the average of the trace statistics for the individual countries.
2. E(Z) is the mean of the asymptotic trace statistic obtained from Larsson (1998).
3. Var(Z) is the variance of the asymptotic trace statistic obtained from Larsson (1998).
4. The statistic is normally distributed, and so the critical values are 1.645 (5%) and 2.326 (1%).

<u>Table 7:</u> Long-run equations, using FSD1

	PSAV	RGPDI	GOVSAV	PCRED	FSD1
Congo	1	1.455	-1.978	-120.770	0.581
		3.849	*3.704*	*0.330*	*1.924*
Cote d'Ivoire	1	-1.272	-0.239	1.230	0.507
		6.297	*1.637*	*8.913*	*2.369*
Egypt	1	-0.205	0.672	0.528	-0.245
		2.440	*1.811*	*5.558*	*1.384*
Gabon	1	-0.621	-0.977	1.299	0.390
		6.978	*8.570*	*68.368*	*2.364*
Gambia	1	-0.102	-1.934	0.771	-0.064
		0.429	*2.512*	*1.913*	*0.346*
Ghana	1	0.017	0.481	-1.447	-0.140
		0.850	*2.797*	*4.990*	*2.333*
Kenya	1	0.750	5.265	-1.246	-0.594
		3.521	*5.922*	*4.514*	*3.264*
Lesotho	1	-0.041	-1.985	-4.982	0.335
		0.366	*2.860*	*5.184*	*3.602*
Madagascar	1	-0.384	-0.073	0.992	0.103
		7.680	*0.465*	*7.241*	*4.292*
Morocco	1	-0.019	3.823	-0.498	-0.100
		0.114	*3.785*	*4.150*	*0.351*
Niger	1	1.148	-0.848	0.585	-0.898
		2.529	*0.767*	*1.444*	*3.680*
Rwanda	1	-0.579	-1.254	0.311	0.255
		3.688	*1.869*	*0.545*	*1.555*
Senegal	1	-0.159	-0.349	0.366	-0.080
		2.524	*0.701*	*24.400*	*1.379*
Sierra Leone	1	-0.308	-3.002	-1.704	0.695
		3.348	*4.210*	*1.455*	*4.187*
South Africa	1	-0.025	0.560	0.481	-0.719
		0.202	*1.618*	*10.932*	*3.473*
Swaziland	1	0.220	0.548	2.223	-1.164
		0.570	*0.937*	*11.005*	*2.213*

Notes: 1. PSAV is normalized to equal 1.
2. Figures in italics are t-values.
3. Botswana is not included on account of lack of FSD1 data

<u>Table 8:</u> Long-run equations, using FSD2

	PSAV	RGPDI	GOVSAV	PCRED	FSD2
Botswana	1	3.241	-1.411	8.695	4.758
		7.333	*2.081*	*21.902*	*2.687*
Congo	1	1.620	-2.357	167.120	1.196
		4.696	*3.851*	*0.418*	*2.426*
Cote d'Ivoire	1	116.200	-49.331	-48.808	-294.600
		5.034	*2.823*	*1.692*	*6.578*
Egypt	1	0.194	37.658	29.428	-16.376
		0.310	*6.721*	*11.113*	*9.018*
Gabon	1	-0.401	-0.562	0.859	0.341
		11.794	*4.460*	*8.765*	*1.201*
Gambia	1	0.414	-3.418	0.585	-1.745
		1.489	*3.590*	*1.585*	*1.985*
Ghana	1	-0.009	-0.391	-0.748	-0.215
		0.409	*1.761*	*4.704*	*1.734*
Kenya	1	-0.333	1.680	1.150	-0.688
		4.897	*4.352*	*3.495*	*4.047*
Madagascar	1	-0.407	-0.247	0.941	0.339
		6.359	*1.816*	*29.406*	*1.622*
Morocco	1	-0.027	1.953	-0.279	-0.403
		0.391	*4.706*	*3.623*	*2.472*
Niger	1	-0.545	-3.392	1.532	0.013
		4.225	*2.644*	*3.095*	*0.040*
Rwanda	1	-2.067	6.235	-7.173	8.511
		7.627	*7.200*	*16.528*	*9.161*
Senegal	1	-0.384	0.926	0.276	0.494
		7.680	*2.537*	*4.000*	*2.398*
Sierra Leone	1	-0.204	-1.238	1.774	0.024
		2.649	*2.272*	*4.078*	*0.089*
South Africa	1	-0.363	-0.425	0.002	0.555
		15.783	*2.500*	*0.105*	*9.569*
Swaziland	1	-0.746	-1.220	0.775	1.836
		9.947	*3.731*	*7.176*	*5.114*

Notes: 1. PSAV is normalized to equal 1.
2. Figures in italics are t-values.
3.Lesotho is not included on account of lack of FSD2 data.

<u>Table 9:</u> Long-run equations, using FSD3

	PSAV	RGPDI	GOVSAV	PCRED	FSD3
Botswana	1	-0.485	0.457	0.957	0.582
		7.239	*2.787*	*3.406*	*1.528*
Congo	1	1.638	-1.699	219.130	0.521
		5.935	*3.378*	*0.578*	*0.471*
Cote d'Ivoire	1	-2.176	10.468	-9.480	18.387
		2.070	*8.894*	*9.386*	*7.639*
Egypt	1	9.902	17.361	184.700	-300.500
		2.964	*0.629*	*11.685*	*11.499*
Gabon	1	-0.439	-2.695	4.576	-3.828
		7.081	*11.276*	*74.771*	*7.390*
Gambia	1	0.312	-3.490	1.942	-3.541
		2.644	*3.921*	*46.238*	*6.403*
Ghana	1	-0.032	-0.019	-0.520	-0.723
		3.556	*0.147*	*2.955*	*2.601*
Kenya	1	-0.374	1.096	0.769	-0.536
		4.065	*2.141*	*1.962*	*2.653*
Lesotho	1	0.381	-4.612	-20.199	7.875
		2.702	*4.730*	*4.299*	*3.538*
Madagascar	1	-0.352	-0.103	0.757	0.391
		8.000	*0.769*	*10.230*	*2.015*
Morocco	1	0.016	4.698	-0.416	-0.581
		0.188	*3.238*	*1.480*	*1.417*
Niger	1	-0.430	-2.433	0.760	0.267
		3.772	*2.978*	*6.496*	*0.699*
Rwanda	1	-0.559	2.043	-2.064	3.233
		5.947	*3.344*	*40.471*	*5.987*
Senegal	1	-0.337	1.102	0.234	0.321
		13.480	*3.800*	*4.255*	*3.821*
Sierra Leone	1	-0.056	0.582	1.919	-1.735
		2.074	*3.404*	*5.941*	*4.766*
South Africa	1	-0.508	2.720	0.383	0.265
		11.545	*6.370*	*15.320*	*2.732*
Swaziland	1	-0.580	0.360	1.446	0.254
		6.988	*1.263*	*9.451*	*0.546*

Notes: 1.PSAV is normalized to equal 1.
2. igures in italics are t-values.