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Savings-Investment Correlations and Capital Mobility in Developing Countries

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Many developing countries are financially integrated in the long run and several show evidence of capital mobility in the short run. Savings-investment correlations are lower for middle-income than for lower-income countries.

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This paper — a product of the Debt and International Finance Division, International Economics Department — is part of a larger effort in the department to study the effects of external financing on developing countries. Copies of the paper are available free from the World Bank, 1818 H Street NW, Washington, DC 20433. Please contact Rose Vo, room S8-042, extension 31047 (October 1993, 28 pages).

Mamingi estimates savings and investment correlations for 58 developing countries to assess the capital mobility (in the Feldstein-Horioka sense) in these countries.

Using a new estimation technique (fully modified ordinary least squares) — which simultaneously corrects for serial correlation, endogeneity, and sample bias (asymptotically) — Mamingi finds that many developing countries are financially integrated in the long run.

More important, the estimates from this robust estimation technique indicate that savings-investment correlations are lower for middle-income than for lower-income countries.

Mamingi also provides evidence of capital mobility for several of these countries in the short run.

Savings-Investment Correlations and Capital Mobility in Developing Countries

by

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1. Introduction

The finding by Feldstein and Horioka (1980) that national saving and domestic investment are highly positively correlated has generated a lot of debate among economists on the extent to which the "capital immobility implication" attributed to this correlation implies lack of financial openness. In fact, despite disagreements over the implications of this finding, the puzzle itself has been replicated in a number of subsequent studies using mainly cross section data from OECD or EC countries (see, for examples, Penati and Dooley (1984) phy (1984), Feldstein and Bachetta (1990), Bayoumi (1990), and Tesar (1991)). Explanations of the puzzle (which have yet to meet the consensus of the protagonists) include analysis of the impacts of sample bias, endogeneity of saving, capital controls and/or fiscal policy, productivity shock and lack of integration of goods markets, and country size (see Tesar (1991) for a discussion of the different arguments).

The few studies on the experiences of developing countries reveal that the magnitude of the coefficient measuring the degree of capital mobility is lower (see Wong (1990) and Montiel (1993)). Wong utilizes a cross-section approach to analyze saving-investment correlations for a sample of 45 countries over the period 1975-1981. Although the correlation (0.08) that he found is lower than those in previous studies, his finding is, nevertheless, very sensitive to influential observations. Thus, after dropping 5 countries, the correlation becomes 0.613. Montiel adopts a

* I would like to thank Ronald Johannes, Stijn Claessens, Punam Chuhan, Vikram Nehru and Yonas Biru for valuable comments.

time series approach with various tests for capital mobility (strength of saving-investment correlations, size of gross capital flows, uncovered interest rate parity and behavior of domestic consumption over time). He is able to show that many developing countries experience capital mobility.

This paper reexamines the evidence on capital mobility on the basis of saving-investment correlations using annual time series data from 58 developing countries for the period from 1970 to 1990 with special attention to the issues of serial correlation, endogeneity of saving, and sample bias. A time series approach is adopted here because the cross-section approach utilized in most of the studies on saving-investment correlations is flawed in many respects (see Gundlach and Sinn, 1992, p. 618). First, results from cross-section models are hard to interpret, at least in this type of exercise. Indeed, as capital mobility estimates are derived at a particular point in time, the key question of how much of an increase in saving truly ends up as domestic investment[1] becomes difficult to answer. Further, the use of long-term averages of savings and investment ratios leads to an upward bias in capital mobility correlations. Second, there is no guarantee that capital mobility estimates for different countries are effectively equal, something cross-section models imply. In fact, for reasons such as capital controls and differences in country size, one would expect capital mobility estimates to vary across countries. Third, since the saving-investment correlation is primarily a long-run relationship, a cointegration (long-run relationship between variables) approach is a more appropriate methodology.

A study of capital mobility is important because different degrees of capital mobility hold different policy implications. In the event of perfect capital mobility, one should expect: (a) monetary policy to be ineffective in influencing the prices of domestic financial assets; and (b) expansionary fiscal policy to be ineffective for purposes of demand management. Whereas complete capital immobility, which implies that domestic investment is entirely financed by

[1]This is pointed out by Gundlach and Sinn, 1992, p.618.

domestic or national saving, should give rise to an active role for monetary and fiscal policies (see Montiel (1993) for further details).

This paper contributes to the literature in three ways. First, the study shows that an omission of a significant time trend in the Feldstein-Horioka regression can, in some cases, either significantly change the capital mobility estimate (i.e., Nepal and Venezuela) or alter the extent of the puzzle (i.e., Burundi, India and Venezuela). This is a well-known variable omission problem, which unfortunately has been overlooked in the literature on saving-investment correlations.

Second, the application of cointegration and error correction models enable us to obtain long-run and short-run estimates of capital mobility.

Third, the use of a robust estimation technique (such as the fully modified ordinary least squares (FMOLS) of Phillips and Hansen (1990)) can, under some conditions, attenuate the extent of the puzzle. The examples of India, Thailand and Paraguay are cases in point. More importantly, contrary to the finding of previous papers, the FMOLS estimates do indicate that saving-investment correlations for middle-income countries are as a whole lower than those for low-income countries.

Overall, this study finds that the evidence of high correlations between saving and investment is largely absent in developing countries.

The paper is organized as follows. Section 2 reports and interprets the ordinary least squares (OLS) estimates from the Feldstein-Horioka regression for developing countries. Section 3 examines the unit root and cointegration properties of the data. Section 4 reexamines the basic regression with fully modified ordinary least squares. Section 5 develops causality analysis to shed light on the issue of endogeneity of saving. It also investigates short-run capital mobility through the error correction models. Section 6 summarizes the main findings.

2. The Feldstein-Horioka Regression: OLS Estimates

The objective of this section is to estimate and to interpret the basic Feldstein-Horioka regression. Annual data on the gross national saving - GDP ratio (S_t) and the gross domestic investment - GDP ratio (I_t) for 58 developing countries (see Table 1) over the period 1970 to 1990 are used. The data are obtained from the World Bank's World Tables 1991 and 1992 (update).

The basic Feldstein - Horioka regression is as follows:

$$I_t = c + bS_t + e_t \tag{1}$$

where the variables are defined as above, c is a constant term and e_t is the error term. According to Feldstein and Horioka (1980), the coefficient b measures the degree of capital mobility and takes values from zero (perfect capital mobility) to one (complete capital immobility).

The OLS estimates from equation (1) are presented in Table 2. The results show that the following countries experience capital mobility at least at the 5 percent level of significance: Brazil, Colombia, Costa Rica, Gambia, Israel, Kenya, Madagascar, Malaysia, Malta, Mauritania, Morocco, Rwanda, Sierra Leone, and Togo. Capital is immobile in the following countries: Burundi, Fiji, Ghana, Guatemala, India, Honduras, Malawi, Nepal, Niger, Sri Lanka, Thailand, Philippines, Tunisia and Venezuela. Other countries of the sample are in an intermediate position (intermediate degree of financial openness). In terms of the coefficient size, sixteen countries have coefficients greater than 0.60 (the benchmark for developed countries established by authors who dealt with OECD and EC countries).

It is well known, however, that the estimate of b in equation (1) can suffer from a variable omission bias. A time trend variable can be expected to be the most important omitted

variable. In fact, it is quite possible that the time trend captures most omitted variables. Thus, equation (1) is modified as follows:

$$I_t = c + bS_t + dT + e_t \tag{2}$$

where I_t and S_t are defined as above and T is the time trend. If equation (2) is true, then the estimate of b in equation (1) is biased.[2]

Surprisingly, a deterministic trend is significant in the regression specification for thirty-two countries. Table 3 reports the OLS estimates. The comparison of Tables 2 and 3 for the above thirty-two countries indicates that for several countries the coefficient b is significantly changed or the conclusion about the degree of capital mobility is substantially altered. This is the case for Côte d'Ivoire, India, Morocco, Pakistan, Sri Lanka, Trinidad and Tobago, Venezuela and Zambia.

As reported in Table 4, the OLS estimates of equations (1) and (2) imply that 21 countries are characterized by perfect capital mobility. The countries are: Colombia, Costa Rica, Côte d'Ivoire, Gambia, Israel, Kenya, Lesotho, Madagascar, Malaysia, Malta, Mauritania, Pakistan, Peru, Rwanda, Sierra Leone, Sri Lanka, Uganda, Togo, Trinidad and Tobago, Venezuela and Zambia. Countries which lack capital mobility are: Fiji, Guatemala, Honduras, Malawi, Niger, Philippines, Thailand and Tunisia. The other countries in our sample display imperfect capital mobility.

Equations (1) and (2) are subject to several econometric problems. First, as is often the case with OLS results from time series data, there is autocorrelation in the error term which introduces bias in the sampling variances and makes the estimates inefficient. In short, the t statistics are unreliable. Second, the savings variable may well be endogenous; implying inconsistent estimates. Third, the small size of the sample introduces a sample bias. Last but

[2]The bias is equal to the "true coefficient of the omitted variable times the regression coefficient of the excluded variable on the included variable" (Maddala, 1977, p. 156).

not least, results are meaningless if savings and investment are integrated of order one (or have different degrees of integration) and their linear combination (that is, e_t) is not stationary. Because of its seriousness, the last problem is investigated first in the next section.

3. Unit Root and Cointegration Properties of the Data

The objective of this section is to study the unit root (non stationarity of the univariate series) and cointegration (long-run relationship between integrated variables) properties of the data to determine whether or not regressions (1) and (2) are spurious.

The (Augmented) Dickey-Fuller test reveals that savings and investment have a unit root (integrated of order one) for all developing countries except for Kenya and Benin (results are available upon request). The unit root result is not clear cut for savings for Burundi, Gambia, Tunisia, Côte d'Ivoire and Chile and for investment for Chile, Colombia, Costa Rica , Malta and Burkina Faso.

As each of the two variables apparently contains a unit root for many countries, it is necessary to examine whether their linear combination is stationary, that is, whether the two variables are cointegrated. If the two variables are cointegrated then the usual statistical inference can proceed normally and the basic results obtained from (1) and (2) can be validated to some extent.

As the usual tests for cointegration (cointegrated Durbin-Watson, Dickey-Fuller, Augmented Dickey-Fuller and Phillips-Ouliaris) have low power against many alternatives given the small sample size, the t statistic of the coefficient of the error correction term in either one of error correction models (see equations (3) and (4) in section 5) is utilized to test for cointegration. Specifically, cointegration is accepted if the t statistic of either a_1 in equation (3) or a_2 in equation (4) is significantly different from zero and negative.

Before reporting the results on cointegration, it is worth emphasizing that cointegration is a desirable property even in the presence of capital mobility contrary to the argument that some authors make about capital mobility implying the absence of cointegration (see, for example, Leachman (1991)). Indeed, as the error term in equation (1) represents the current account balance, the solvency property requires e_t to be bounded (Montiel, 1993, p. 32). The following quote also reinforces this idea "It cannot be concluded, however, that a country is shut off from the international capital market if its current account balance is found to be integrated of order zero, I(0). A number of studies suggest that over time both saving and investments rates are influenced by the same exogenous variables. In that case saving and investment rates could be cointegrated and the current account balance would be I(0) even if the country is linked to international capital market (Gundlach and Sinn, 1992, p. 618))."

The results reported in Table 8 indicate that the t statistic is significant at the 10 and 5 per cent level and negative in equation (3); hence cointegration is accepted in all the relationships examined here (with the exceptions of Kenya and Benin whose variables in levels are already stationary). Although the results presented so far for equations (1) and (2) are acceptable, there are problems of serial autocorrelation, endogeneity of saving and sample bias which need to be taken care of. The next section deals with these issues using fully modified OLS technique.

4. Fully Modified OLS Estimates

The fully modified OLS of Phillips and Hansen (1990), (FMOLS) is utilized in equations (1) and/or (2). This technique corrects for endogeneity and serial correlation and asymptotically eliminates the sample bias.

In the literature on saving-investment correlations, the instrumental variable (IV) method has been commonly used to solve the problem of endogeneity of saving. However, aside from endogeneity, there are problems of serial correlation and sample bias that need to be addressed

and the IV method does not solve them. In a cointegration context, sample bias may occur not only in small sample sizes but also in moderate or even large sample sizes (second-order sample bias). The IV estimates may be useful as first estimates of the FMOLS if the ratio signal to noise is low. Otherwise, the OLS estimates are used as first estimates of the FMOLS. In this paper, the latter method is pursued (see appendix 1 for details on FMOLS)

Table 5 reports the FMOLS estimates. Since the length of the lag truncation to be used in the estimation of the long-run covariance matrix is not clear cut, although Phillips and Hansen (1990) rely on the cross correlogram between the "innovations" and the "exogenous variable" as well as on the correlogram of the innovations, the final *b* estimate obtained here is the mean of the *b* coefficients from different lag truncations. The standard error is also obtained analogously to the final *b*. Table 6 translates the results of the previous table in terms of capital mobility. These results are the correct long-run estimates of capital mobility. As can be seen, only 11 out of 58 countries fail to demonstrate any degree of capital mobility. The comparison of Tables 4 and 6 shows that several countries have changed their status in terms of capital mobility. Thus, for example, Costa Rica, Côte d'Ivoire, Malaysia, Malta, Lesotho, Togo, and Zambia are no longer in the category of "mobile capital". Instead, except for Zambia, there are now in the category of " imperfect mobile capital".

Table 7 quantifies the relationship between saving-investment correlations and country size by way of simple correlations or Spearman's rank correlations. Contrary to previous findings, the correlation coefficients indicate that saving-investment FMOLS estimates and country size are negatively correlated. This is particularly true for a small sample of countries (eight). In other words, the larger the country, the lower is the correlation between saving and investment, hence, the more mobile is capital in the country.

To sum up, the FMOLS estimates show that a large number of countries do experience capital mobility in one form or another contrary to results obtained in earlier studies and there is

a negative relationship between saving-investment correlation estimates and country size. Policy implications can be directly inferred from the size of capital mobility estimates. In this respect, several papers explain them well (see Montiel (1993) in particular). Although this is not the place to duplicate these papers, we can, nevertheless, emphasize that, among others, this finding means that in many third world countries monetary policy is ineffective in dictating the price of financial assets and fiscal policy is powerless in the sense that the crowding out effect on private investment does not occur.

5. Causality and Short-run Capital Mobility

This section deals with causality analysis to shed light on endogeneity or exogeneity of saving in equations (1) or (2), and estimates short-run capital mobility. These two goals are pursued in the framework of error correction models (ECMs).

Exogeneity or causality analysis is important to the extent that it can legitimize the use of instrumental variables techniques. Note that in the literature endogeneity of saving is taken as granted. In fact, the support for the IV approach is weakened if it is shown that saving is exogenous (the FMOLS estimates are not affected by this remark (see Phillips and Hansen (1990)). The study on short-run capital mobility is undertaken to show that capital mobility is also a short run phenomenon.

An error correction model is either a vector autoregression or a dynamic model which contains both short and long run elements. In other words, in these models, the change in one variable is explained by the past equilibrium error, the present/or the past change of the other variable(s) and the past change of the explained variable. The dynamic version of the ECM derived from Hendry's approach to econometrics is of interest here to capture short-run capital mobility. The vector autoregression approach helps us conduct causality analysis

Causality and exogeneity are linked. Briefly, in equations (3) and (4), S_t is said to be weakly exogenous with respect to the parameters of interest if $cov(u_t, u'_t) = 0$, that is, basically the lagged error term and the past of I_t do not belong to equation (4). S_t is strongly exogenous if S_t is weakly exogenous and I_t does not Granger cause S_t. As can be seen causality is an important component of exogeneity. In this paper, the emphasis is more on causality than on exogeneity.

Causality in the Granger sense is utilized here. According to Granger (1969), a variable S_t does not Granger cause another variable I_t if the past of S_t does not help better predict I_t than does the past of I_t alone. Granger causality can be tested using either the usual vector autoregression or the error correction models. In fact, if variables are cointegrated, then Granger causality is adequately tested in the ECM framework. Precisely, for the two variables of interest, the following ECMs can be fitted:

$$\Delta I_t = c + a_1 e_{t-1} + lagged(\Delta I_t, \Delta S_t) + u_t \tag{3}$$

$$\Delta S_t = c + a_2 e_{t-1} + lagged(\Delta I_t, \Delta S_t) + u_t \tag{4}$$

where e_{t-1} is the lagged error correcting term from (1) or (2), Δ is the first difference operator, the u's are the error terms supposed to be white noise.

The "Granger representation theorem" states that every cointegrated vector has a valid error correction model representation, that is, at least one of the a's in the above equations is different from zero and negative. Clearly, if $a_1 < 0$ and significantly different from zero, then the ECM (3) is valid and Granger causality runs from S_t to I_t or precisely from the lagged equilibrium error to I_t.

The results presented in Table 8 show that causality runs from savings to investment in all the countries under investigation as the *t* statistics indicate except for Burkina Faso, Chile, Colombia and Korea where a feedback seems to prevail.

The unidirectional causality indicates that saving is likely to be an exogenous variable rather than an endogenous variable contrary to the current literature, with the exceptions of Burkina Faso, Chile, Colombia and Korea. In other words, the IV method can only be justified for these four countries. Thus, (1) and (2) are valid regressions and short-run capital mobility can be tested with the following:

$$\Delta I_t = c + a_3 e_{t-1} + \beta \Delta S_t + u_t \qquad (5)$$

$$\Delta S_t = c + u_t \qquad (6)$$

where $a_3 < 0$ and significantly different from zero, the *u*'s are white noise and β is the multiplier of impact which here captures short-run capital mobility. It is worth noting that in the real Hendry's methodology it is not the lagged error correcting term from (1) (or (2)) which is the lagged error correcting term but the one period lag of $(I_t - c - b\, S_t)$. Further, the lagged variables have not been added to preserve the degree of freedom.

Table 9 presents the results of the inquiry. Accordingly, the following countries experience capital mobility in the short-run (see Table 10): Algeria, Brazil, Colombia, Costa Rica, Côte d'Ivoire, Ecuador, El Salvador, Fiji, Gambia, Guatemala, Haiti, Israel, Jamaica, Korea, Lesotho, Malawi, Malaysia, Malta, Mauritius, Morocco, Nigeria, Pakistan, Rwanda, Sri Lanka, Paraguay, Thailand, Togo, Trinidad and Tobago, and Uganda. Capital immobility is registered by Egypt, Honduras, Niger and Mauritania. Five others countries experience imperfect capital mobility.

6. Summary and Concluding Remarks

This paper estimates saving-investment correlations for 58 developing countries in order to assess the degree of capital mobility (in the Feldstein-Horioka sense) for these countries. The paper utilizes a time series approach and pays special attention to the problems of serial correlation, endogeneity of saving and sample bias.

Using a new estimation technique (fully modified ordinary least squares), [illegible] study finds that many developing countries are financially integrated in the long-run. The [illegible] s of this robust estimation technique indicate that in the context of developing coun[illegible]s. avings-investment correlations are in general lower for middle-income countries than for low-income countries. Further, using an error correction model à la Hendry, the paper also provides evidence of capital mobility in the short-run in several of these countries. Overall, our results indicate that saving-investment correlations are much lower for developing countries than those obtained by other studies using mainly OECD or EC data.

The finding of low saving-investment correlations implies that financial assets in several developing countries are mobile, especially in the long-run. As these countries are small open economies, expansionary fiscal policy is ineffective for purposes of demand management to the extent that private investment is not crowded out. Further, under a fixed exchange rate regime, monetary policy is ineffective in dictating the prices of domestic financial assets. Naturally, the extent of these macroeconomic policy implications largely depends on the degree of capital mobility of countries. Our results indicate that the above macroeconomic policy effects (i.e., ineffectiveness of fiscal policy) are more present in middle-income countries than in low-income countries.

Two areas are relevant for further research. First, aid flows could be included in the basic model in order to test the robustness of results obtained here. Second, the sensitivity of the negative relationship between saving-investment correlations and country size to change in country sample could be investigated.

Appendix 1

Derivation of FMOLS estimators (see Hansen and Phillips,1990, p.227-234).

Let us suppose the following:

$$y_t = c + bx_t + u_{1t}$$
$$x_t = x_{t-1} + u_{2t}$$

where y_t and x_t are the variables of interest and $u_t = (u_{1t}, u_{2t}')$ is a vector of stationary disturbances with ergodic zero mean and finite positive covariance matrix (Σ). It is the possible correlation between the two components of u_t which brings about endogeneity of x_t. The long-run covariance matrix (Ω) and other statistics are necessary to obtain FMOLS estimators:

$$\Omega = \begin{bmatrix} \omega_{11} & \omega_{12} \\ \omega_{21} & \omega_{22} \end{bmatrix}$$
$$\Omega = \Delta + \Lambda'$$
$$\Delta = \Sigma + \Lambda = \begin{bmatrix} \Delta_{11} & \Delta_{12} \\ \Delta_{21} & \Delta_{22} \end{bmatrix}$$
$$\Sigma = E(u_0 u_0')$$
$$\Lambda = \sum_{k=1}^{\infty} E(u_0 u_k')$$
$$\omega_{11\,2} = \omega_{11} - \omega_{12}\omega_{22}^{-1}\Delta x_t$$
$$y_t^f = y_t - \omega_{12}\omega_{22}^{-1}\Delta x_t$$
$$u_t^f = u_t - \omega_{12}\omega_{22}^{-1}\Delta x_t$$
$$\Delta_{21}^f = \Delta_{21} - \omega_{12}\omega_{22}^{-1}\Delta_{22}$$

where $\omega_{11.2}$ is the conditional variance of u_t, given the change in the variable x_t and f stands for FMOLS.

In fact, to obtain the FMOLS estimators of interest, Δ and Ω are tentatively estimated as follows:

$$\hat{\Delta} = T^{-1}\sum_{k=0}^{l}\sum_{t=k+1}^{T} u_{t-k}u_t'$$

$$\hat{\Omega} = T^{-1}\sum_{1}^{T} u_t u_t' + T^{-1}\sum_{k=1}^{l}\omega_{kl}\sum_{t=k+1}^{T}(u_{t-k}u_t' + u_t u_{t-k}')$$

where the weights ω_{kl} =1-*k/(l*+1*)* are utilized to make the long-run covariance matrix positive definite and *l* is the lag truncation.

The fully modified estimator a^f, standard errors s^f and t statistic t^f are, respectively:

$$a^f = (X'X)^{-1}[X'y^f - i_m T\hat{\Delta}_{21}^f]$$
$$s_i^f = [(X'X)_{ii}^{-1}\hat{\omega}_{11.2}]^{1/2}$$
$$t_i^f = (a_i^f - a_i^0)/s_i^f$$

where *X* represents all the right-hand side variables including the constant, $a^f = (c, b^f)'$ *and*

$$i_m = \begin{bmatrix} 0 \\ 1 \end{bmatrix}$$

Note that the FMOLS estimator is asymptotically equivalent to the maximum likelihood estimator applied to the whole system.

Appendix 2: Tables

The data for the different tables are from the World Bank's World Tables 1991 and 1992 (update).

Table 1: List of Countries

Algeria	Nepal
Benin	Niger
Brazil	Nigeria
Burkina Faso	Pakistan
Burundi	Paraguay
Cameroon	Peru
Central African Repub.	Philippines
Chile	Rwanda
Colombia	Senegal
Congo	Sierra Leone
Côte d'Ivoire	Sri Lanka
Costa Rica	Thailand
Dominican Republic	Togo
Ecuador	Trinidad & Tobago
Egypt	Tunisia
El Salvador	Turkey
Fiji	Uganda
Gabon	Venezuela
Gambia	Zambia
Ghana	Zimbabwe
Guatemala	
Haiti	
Honduras	
India	
Israel	
Jamaica	
Kenya	
Korea Republic	
Lesotho	
Madagascar	
Malawi	
Malaysia	
Mali	
Malta	
Mauritania	
Mauritius	
Mexico	
Morocco	

Table 2: Regression Results: OLS Estimates (see eq.(1))

Country	b	$\bar{R}^2$	DW	Country	b	$\bar{R}^2$	DW
Algeria	0.56 (0.17)	0.34	0.96	Benin	0.42 (0.21)	0.13	0.85
Brazil	0.09 (0.09)	-0.00	0.63	Burkina	0.38 (0.16)	0.19	0.67
Burundi	0.75 (0.29)	0.22	0.56	Camer.	0.36 (0.09)	0.42	1.30
C. Af. R.	0.57 (0.11)	0.57	1.56	Chile	0.55 (0.13)	0.46	1.34
Colom.	-0.08 (0.11)	-0.03	1.77	Congo	0.53 (0.16)	0.32	0.86
C. Rica	0.19 (0.17)	0.06	1.46	Côte Iv.	0.40 (0.14)	0.26	0.89
Dom. R.	0.35 (0.13)	0.23	1.27	Ecuador	0.51 (0.17)	0.27	1.55
Egypt	0.68 (0.15)	0.49	0.71	El Salv.	0.57 (0.11)	0.55	1.66
Fiji	0.75 (0.26)	0.26	0.57	Gabon	0.57 (0.17)	0.34	1.01
Gambia	-0.14 (0.29)	0.01	0.46	Ghana	0.74 (0.17)	0.46	1.25
Guate.	0.89 (0.16)	0.60	1.95	Haiti	0.28 (0.13)	0.15	0.63
Hondu.	0.83 (0.13)	0.53	1.20	India	0.97 (0.16)	0.65	0.27
Israel	-0.21 (0.32)	-0.03	0.19	Jamaica	0.74 (0.17)	0.46	1.38
Kenya	0.22 (0.22)	0.00	1.81	Korea	0.33 (0.09)	0.36	1.05
Lesotho	-0.36 (0.23)	0.06	0.38	Madaga.	0.02 (0.23)	-0.05	0.64
Malawi	0.88 (0.25)	0.36	1.11	Malaysia	0.11 (0.32)	-0.05	0.45

Table 2: Regression Results (continued)

Mali	0.16 (0.07)	0.17	0.52	Malta	0.10 (0.10)	-0.00	0.98
Maurita.	-0.03 (0.22)	-0.05	1.02	Mauritius	0.61 (0.19)	0.34	0.70
Mexico	0.28 (0.15)	0.10	0.61	Morocco	-0.15 (0.21)	0.34	0.70
Nepal	1.05 (0.14)	0.72	0.44	Niger	0.97 (0.14)	0.71	1.14
Nigeria	0.61 (0.13)	0.52	1.43	Pakistan	0.20 (0.06)	0.44	0.74
Philippi.	1.24 (0.20)	0.66	1.10	Rwanda	-0.06 (0.14)	-0.04	0.67
Senegal	0.35 (0.08)	0.48	0.63	S.Leone	-0.04 (0.12)	-0.04	1.12
Sri Lanka	0.70 (0.38)	0.11	0.64	Thailand	0.74 (0.19)	0.41	1.03
Paraguay	0.53 (0.22)	0.19	0.44	Peru	-0.007 (0.005)	0.05	0.77
Togo	0.13 (0.21)	-0.03	0.71	Trinidad	0.28 (0.12)	0.18	0.68
Tunisia	0.92 (0.23)	0.42	0.97	Turkey	0.41 (0.14)	0.28	1.20
Uganda	-0.24 (0.13)	0.11	0.20	Venez.	0.71 (0.21)	0.33	1.09
Zambia	0.49 (0.10)	0.53	1.98	Zim'bwe	0.54 (0.14)	0.43	0.88

Note: Equation (1) is of interest with the *b* estimates and the standard errors in parentheses as well as the adjusted R^2 and the Durbin-Watson statistic for autocorrelation (*DW*).

Table 3: OLS Estimates with a Time Trend (see equation 2).

Co'try	b	d	$\bar{R}^2$	D.W	Co'try	b	d	$\bar{R}^2$	DW
Algeria	0.46 (0.16)	-0.36 (0.16)	0.45	1.09	Brazil	0.15 (0.09)	-0.19 (0.10)	0.11	0.90
Burun.	0.50 (0.17)	0.69 (0.11)	0.75	1.58	Chile	0.54 (0.12)	0.16 (0.10)	0.50	1.53
Colom.	-0.16 (0.13)	0.07 (0.05)	0.00	2.00	Congo	0.66 (0.15)	-0.81 (0.28)	0.51	1.40
C.Rica	-0.11 (0.19)	0.21 (0.09)	0.22	2.02	Côte I.	0.22 (0.13)	-0.54 (0.19)	0.47	0.70
Egypt	0.78 (0.12)	0.52 (0.13)	0.71	1.32	Fiji	0.81 (0.22)	-0.44 (0.14)	0.49	0.91
Gamb.	-0.24 (0.25)	0.69 (0.24)	0.25	0.70	India	0.67 (0.10)	0.20 (0.03)	0.89	1.45
Israel	0.03 (0.11)	-0.76 (0.06)	0.87	1.44	Leso.	-0.01 (0.10)	2.67 (0.26)	0.86	1.46
Meda.	0.08 (0.22)	0.18 (0.10)	0.06	0.77	Malawi	0.73 (0.24)	-0.40 (0.17)	0.47	0.55
Malay.	-0.20 (0.33)	0.37 (0.18)	0.19	0.55	Mali	0.17 (0.05)	0.25 (0.05)	0.60	1.12
Mexico	0.52 (0.19)	-0.20 (0.11)	0.21	0.71	Moro.	-0.74 (0.23)	0.64 (0.18)	0.37	1.73
Nepal	0.60 (0.06)	0.52 (0.04)	0.96	2.49	Nigeria	0.54 (0.12)	-0.34 (0.16)	0.59	1.63
Pakis.	0.04 (0.08)	0.19 (0.09)	0.51	0.67	Parag.	0.52 (0.19)	0.31 (0.12)	0.38	0.59
Rwan.	-0.01 (0.11)	0.34 (0.08)	0.44	1.32	Sene.	0.21 (0.07)	-0.31 (0.07)	0.73	1.11
Sierra	-0.10 (0.11)	-0.19 (0.08)	0.15	1.55	Sri La.	0.37 (0.38)	0.39 (0.19)	0.23	0.59
Trinid.	0.09 (0.10)	-0.61 (0.16)	0.52	1.04	Ugan.	-0.00 (0.06)	0.74 (0.08)	0.82	0.74
Vene.	0.20 (0.31)	-0.85 (0.40)	0.44	0.99	Zamb.	0.03 (0.17)	-1.19 (0.39)	0.67	1.79

Note: Equation (2) is of interest with the *b* and *d* estimates, the standard errors in parentheses, the adjusted R^2 and the Durbin-Watson Statistic for autocorrelation (*DW*).

Table 4: Capital Mobility with OLS Estimates

Mobile	Mobile	Intermediate	Intermediate	Immobile
Colombia	Togo	Algeria	Jamaica	Fiji
Costa Rica	Trinidad & Tob.	Benin	Korea	Guatemala
Côte d'Ivoire	Uganda	Burkina Faso	Mali	Malawi
Gambia	Venezuela	Burundi	Mauritius	Niger
Israel	Zambia	Cameroon	Mexico	Philippines
Lesotho	Sri Lanka	Central Af. R.	Nepal	Tunisia
Madagascar	Kenya	Chile	Nigeria	Honduras
Malaysia		Congo	Paraguay	Thailand
Malta		Dominican R.	Senegal	
Mauritania		Ecuador	Zimbabwe	
Pakistan		Egypt	Brazil	
Peru		El Salvador	Ghana	
Rwanda		Gabon	Haiti	
Sierra Leone		India	Turkey	

Note: Mobile: b in Table 2 or 3 is statistically equal to zero at the 5% level; intermediate: b is statistically different from zero and one and $0 < b<1$; immobile: b is statistically different from zero and not different from one. The result for Morocco is ambiguous (see Table 3). We do not consider other negative coefficients (i.e., Colombia, Costa Rica, Gambia, Uganda and Malaysia) ambiguous because they are not significantly different from zero, at least at the 5% level.

Table 5: FMOLS Results (see Appendix 1 for details)

Country	b	Country	b	Country	b	Country	b
Algeria*	0.40 (0.21)	Brazil*	0.33 (0.11)	Burkina	0.56 (0.18)	Burundi*	0.60 (0.23)
Camer.	0.32 (0.12)	C. Af. R.	0.58 (0.12)	Chile	0.72 (0.12)	Colom.	-0.07 (0.10)
Congo	0.65 (0.18)	Costa R.*	-0.56 (0.14)	Côte Iv.*	0.40 (0.19)	Dom. R.	0.40 (0.13)
Ecuador	0.55 (0.17)	Egypt*	0.62 (0.10)	El Salva.	0.64 (0.10)	Fiji	1.16 (0.23)
Gabon	0.67 (0.21)	Gambia*	-0.17 (0.35)	Ghana	0.84 (0.19)	Gu'mala*	1.09 (0.15)
Haiti	0.17 (0.20)	Honduras	0.84 (0.17)	India*	0.50 (0.12)	Israel*	0.20 (0.12)
Jamaica	0.94 (0.19)	Korea	0.10 (0.23)	Lesotho*	0.51 (0.21)	Mad'car*	0.25 (0.23)
Malawi*	0.98 (0.21)	Malaysia *	-1.39 (0.45)	Mali*	0.09 (0.06)	Malta	0.24 (0.12)
Mau'nia*	0.25 (0.27)	Mau'tius*	0.48 (0.19)	Mexico	0.29 (0.19)	Morocco	-0.67 (0.29)
Nepal*	0.59 (0.18)	Niger	1.08 (0.26)	Nigeria*	0.64 (0.10)	Pakistan*	-0.01 (0.10)
Par'guay*	0.28 (0.22)	Peru	0.01 (0.01)	Philippi.	1.14 (0.22)	Rwanda*	-0.11 (0.12)
Senegal*	0.36 (0.07)	Sierra L.*	-0.29 (0.11)	Sri Lan.*	0.09 (0.52)	Thailand	0.33 (0.15)
Togo	0.53 (0.26)	Trinid.*	0.17 (0.10)	Tunisia	1.06 (0.27)	Turkey	0.28 (0.14)
Uganda*	-0.15 (0.14)	Venez'la*	0.35 (0.30)	Zambia	0.80 (0.21)	Zim'bwe	0.55 (0.16)

Note: The *b* estimates and their standard errors in parentheses are the mean estimates of different lag truncations (1 to 5) of the long run covariance matrices with the exceptions of Uganda (1 to 4 lags), Mauritania (1 to 3 lags) and Mauritius (1 to 4 lags). (*) : means that a time trend is included.

Table 6: Capital Mobility with FMOLS Estimates

Mobile	Intermediate	Intermediate	Immobile
Colombia	Algeria	Nepal	Fiji
Gambia	Brazil	Malta	Guatemala
Haiti	Burundi	Mauritius	Honduras
Israel	Burkina Faso	Togo	Jamaica
Korea	Côte d'Ivoire	Senegal	Malawi
Madagascar	Central Af. Rep.	Thailand	Niger
Mali	Cameroon	Nigeria	Tunisia
Mauritania	Congo	Turkey	Ghana
Pakistan	Chile		Gabon
Rwanda	Dominican Republic		Philippines
Paraguay	Ecuador		Zambia
Peru	Egypt		
Sri Lanka	El Salvador		
Mexico	India		
Trinidad & Tobago	Lesotho		
Uganda			
Venezuela			

Note: Mobile: b in Table 5 is statistically equal to zero at the 5% level; intermediate: b is statistically different from zero and one and $0 < b < 1$; immobile: b is statistically different from zero and not different from one. The results for Costa Rica, Malaysia, Morocco and Sierra Leone are ambiguous.

Table 7: Correlations between Saving-Investment Estimates and Country Size (1987 US dollar GNP per capita)

Type of Correlation		FMOLS Estimates	OLS Estimates
Simple Correlation	1990 GNP for 34 Countries	-0.313** (-1.865)	-0.188 (-1.082)
Simple Correlation	Average GNP (1970-1990) for 34 Countries	-0.188 (-1.082)	-0.184 (-1.062)
Simple Correlation	1970 GNP for 34 Countries	-0.090 (-0.531)	-0.184 (-1.062)
Spearman's Rank Correlation	Average GNP (1970-1990) for 8 countries	-0.881* (-4.561)	-0.381 (-1.009)

Note. Sources: GNP: World Tables 1992 update. FOLS: Table 5. OLS : Table 2 or 3. GNP: 1987 US dollar GNP per capita. Cross section correlations between saving-investment estimates and country size are calculated. Countries with negative saving-investment estimates have been excluded. 1990 GNP: GNP per capita for 34 countries are collected for 1990. Average GNP: an average for GNP per capita over the period 1970-1990 is computed for each country. 1970 GNP: GNP per capita for 34 countries are collected for 1970. Coefficients are simple correlations or Spearman's rank correlations. The Spearman's rank correlation coefficient is obtained by ranking the observations in each series and by calculating the correlation between the ranks of the two series. This correlation is used here for very small sample size (8 countries). The eight countries are the following: Burkina Faso, India, Korea, Mauritius, Paraguay, Thailand, Togo, and Trinidad and Tobago. (.) are the t statistics : $t = (r\sqrt{n-2}) / \sqrt{1-r^2}$ with n the sample size and r the correlation coefficient. (*) and (**) mean significant at the 1% and 10% levels, respectively.

Table 8: Granger Causality from the ECMs (see equation (3))

Country	t_{a1}	Country	t_{a1}	Country	t_{a1}	Country	t_{a1}
Algeria*	-1.951	Brazil*	-3.150	Burkina	-2.934	Burundi*	-1.909
Camer.	-2.726	Centraf	-1.420	Chile*	-3.022	Colomb.	-3.706
Congo	-2.809	C.Rica*	-2.524	Côte Iv.*	-2.663	Dom. R.	-2.921
Ecuador	-2.398	Egypt*	-2.033	El Salv.	-2.713	Fiji	-2.609
Gabon	-1.802	Gambia*	-1.765	Ghana	-2.047	Guate.*	-2.110
Haiti	-1.563	Hondur.	-2.746	India*	-2.461	Israel*	-3.513
Jamaica	-1.848	Korea	-2.477	Lesotho*	-2.559	Madag.*	-2.266
Malawi	-1.794	Malays.*	-2.466	Mali*	-1.832	Malta	-1.813
Maurita.*	-2.007	Mau'tius*	-4.602	Mexico*	-1.729	Morocco	-2.462
Nepal*	-2.433	Niger	-2.409	Nigeria	-5.136	Pakistan*	-1.862
Parag.*	-3.390	Peru	-2.881	Philip.	-4.226	Rwanda	-3.167
Senegal*	-3.914	S.Leone*	-3.078	S.Lanka*	-2.102	Thailand	-2.244
Togo	-2.179	Trinid.*	-2.769	Tunisia	-2.954	Turkey	-2.903
Uganda*	-2.245	Venez.*	-2.476	Zambia	-2.674	Zim'bwe	-1.844

Note: The results of eq. (3) are reported here; those of eq. (4) are not significant with the exceptions of Burkina Faso, Chile and Korea. The t statistics of a_1 have the following critical values: -1.341 and -1.753 at the 10 and 5 percent level of significance, respectively. Equation (3) is utilized with one lag of the change in the variables with the exceptions of Colombia (no lag), Côte d'Ivoire (3 lags), Nepal (no lag), Pakistan (2 lags), Rwanda (no lag) and Thailand (no lag). Naturally, for the latter countries, the critical values are different. (*) means that the error correcting term comes from a model with a time trend term.

Table 9: Short-run OLS Estimates (β) from equation (5)

Country	β	Country	β	Country	β	Country	β
Algeria	0.09 (0.18)	Brazil*	0.02 (0.05)	Burkina	0.34 (0.13)	Burundi*	0.53 (0.13)
Camer.	0.33 (0.13)	C. Afr. R.	0.37 (0.13)	Chile*	0.48 (0.12)	Colombia	-0.18 (0.15)
Congo	0.38 (0.18)	Costa R.*	-0.20 (0.18)	Côte Iv.*	0.07 (0.06)	Dom. R.	0.19 (0.09)
Ecuador	-0.14 (0.23)	Egypt*	1.09 (0.29)	El Salva.	0.21 (0.14)	Fiji	0.28 (0.18)
Gabon	0.36 (0.18)	Gambia*	-0.15 (0.12)	Ghana	0.33 (0.16)	Guate'la*	0.41 (0.27)
Haiti	0.14 (0.10)	Honduras	0.73 (0.24)	India*	0.82 (0.07)	Israel*	-0.13 (0.09)
Jamaica	0.21 (0.17)	Korea(-)	-0.28 (0.21)	Lesotho*	0.12 (0.10)	Mad'car*	-0.49 (0.29)
Malawi*	0.28 (0.28)	Malaysia*	-0.001 (0.20)	Mali*	0.14 (0.04)	Malta	-0.12 (0.15)
Maurita.*	0.70 (0.35)	Mauritius	0.13 (0.21)	Mexico*	0.51 (0.18)	Morocco	0.03 (0.22)
Nepal*	0.69 (0.08)	Niger	0.78 (0.14)	Nigeria*	0.07 (0.12)	Pakistan*	0.06 (0.07)
Pa'guay*	0.16 (0.14)	Peru	0.51 (0.17)	Philippi.	0.48 (0.20)	Rwanda*	-0.04 (0.10)
Senegal*	0.13 (0.08)	Sierra L.*	0.41 (0.10)	Sri Lan.*	0.01 (0.26)	Thailand	0.39 (0.27)
Togo	0.03 (0.15)	Trinid.T.*	-0.09 (0.07)	Tunisia	0.31 (0.16)	Turkey	0.48 (0.20)
Uganda*	-0.02 (0.07)	Venez'la	-0.31 (0.27)	Zambia*	-0.22 (0.13)	Zim'bwe	0.61 (0.16)

Note: (.): standard errors; (*): an error correcting term from (2) is of interest; (-) : presence of two error correction models. All the regressions pass the tests of autocorrelation, ARCH, heteroscedasticity and misspecification. One lag is included in eq. (5) for Madagascar, Togo, Peru, Honduras and Mauritius.

Table 10: Capital Mobility in the Short-Run

Mobile	Mobile	Intermediate	Immobile
Algeria	Pakistan	Burundi	Mauritania
Brazil	Rwanda	Cameroon	Niger
Colombia	Sri Lanka	Central African Rep.	Egypt
Costa Rica	Paraguay	Chile	Honduras
Côte d'Ivoire	Thailand	Congo	
Ecuador	Trinidad & Tobago	Gabon	
El Salvador	Togo	Mali	
Fiji	Uganda	Mexico	
Gambia	Mauritius	Nepal	
Guatemala		Senegal	
Haiti		Sierra Leone	
Israel		Tunisia	
Jamaica		Turkey	
Korea		Zimbabwe	
Lesotho		Burkina Faso	
Malawi		Dominican R.	
Malaysia		Peru	
Malta		Philippines	
Morocco		India	
Nigeria		Ghana	

Note: This table is derived from Table 8. The degree of mobility (β in eq. (5)) is defined analogously to that in Table 6. The results for Madagascar, Zambia and Venezuela are ambiguous

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