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An exploration of the long-run relationship between saving and investment in the developing economies: a tale of Latin American countries

In the past eighteen years economists have been studying the relationship between saving and investment with renewed vigor. The biggest impetus has come from Feldstein and Horioka (1980). The main focus of the literature following Feldstein and Horioka is international capital mobility in the industrialized countries. With more sophisticated econometric methodology and more data availability for other countries, we are beginning to understand the relationship between saving and investment better. We are also recognizing the implications of the presence or absence of close relationships between saving and investment.

Sixty years ago Keynes recognized the importance of the connection between saving and investment. In his classic, the *General Theory of Employment, Interest and Money* (1973), he explains:

The prevalence of the idea that saving and investment, taken in their straightforward sense, can differ from one another, is to be explained, I think, by an optical illusion due to regarding an individual depositor's relation to his bank as being a one-sided transaction, instead of a two-sided transaction, which it actually is. . . . But no one can save without acquiring an asset, whether it be cash or a debt or capital-goods; and no one can acquire an asset which he did not previously possess, unless either an asset of equal value is newly produced or someone else parts with an asset of that value which he previously had. In the first

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alternative there is a corresponding new investment; in the second alternative someone else must be dissaving an equal sum. For his loss of wealth must be due to his consumption exceeding his income, and not to a loss on capital account through a change in the value of a capital asset, since it is not a case of his suffering a loss of value which his asset formerly had; he is duly receiving the current value of his asset and yet is not retaining this value in wealth in any form, i.e., he must be spending it on current consumption in excess of current income. [pp. 81–82]

Keynes was clearly focused on an economy with individuals as the basic decision-making units. In this paper, we extend this Keynesian idea to a multicountry environment with each country as the basic unit of analysis. Latin American countries provide an ideal dataset for testing macroeconomic time series over the past half-century because many of them have gone through clearly identifiable major macroeconomic crises over this period.

It has been argued in the literature (for example, Miller, 1988) that saving rate and investment rate should be cointegrated under certain conditions (for example, under fixed exchange regimes). In this paper we show that, even under fixed exchange regimes, saving rate and investment rate are not cointegrated precisely in those Latin American economies that experienced exchange rate and/or current account crises.

A helicopter tour of ten Latin American economies

The basic features of saving and investment for the ten economies studied are summarized below. For other countries in the region, long enough datasets to carry out time-series analysis are not available.

Colombia

The most striking feature for Colombia is the divergence of saving and investment in the 1970s and again in the late 1980s. The main reasons behind the divergence are political uncertainty and associated high rates of inflation. A recent surge of foreign investment is directly attributable to sweeping economic reform and the development of Cusiana oil fields.

Dominican Republic

Unlike Colombia, Dominican Republic has a long history of saving and investment following each other closely, with the unusual feature of saving persistently lagging behind investment since the early 1960s.

Ecuador

Ecuador has two main cash “crops”: oil and bananas. With the growth of oil prices in the 1970s, saving received a boost in Ecuador. However, a relative drop in banana prices in the following decades saw the saving fall somewhat.

El Salvador

The picture for El Salvador tells a remarkably sad story of the economic consequence of civil wars. In the 1980s, the economy was ravaged by a decade-long civil war that saw hundreds of thousands dead, others fleeing the country, and a consequent drop in saving in the economy. But, with recent privatization efforts of the democratically elected government, investment has picked up since 1990.

Guatemala

Political uncertainty and the consequent economic fallout have played havoc with the economy resulting in a large exodus of Guatemalans into Mexico and the United States. This has led to a sharp drop in domestic saving. However, recent encouragement of foreign investment (mainly in agriculture) has led to a resurgence of investment, especially with the emergence of democracy in the 1990s.

Honduras

One of the poorest countries in the Western hemisphere (with Nicaragua and Haiti), Honduras is largely dependent on agriculture. The main cash crops are coffee and bananas. In Honduras, saving tracked investment closely over the period under study except for 1975–85, when political turmoil led investment to exceed saving.

Jamaica

Saving and investment followed each other quite closely in this small Caribbean country. However, foreign investment in bauxite mining and tourism has kept investment in Jamaica somewhat ahead of saving.

Mexico

Mexico was characterized by a steady simultaneous rise in saving and investment over 1950–80, followed by divergence between the two with a severe contraction of investment in the 1980s. In the past five years,

investment has been running ahead of saving, culminating in the biggest currency crisis in history.

Panama

In the entire time frame, investment and saving have followed each other closely. Panama is a very small economy with heavy dependence on offshore banking and flag of convenience facilities for ships. With the fall of General Manuel Noriega, the country went through a sharp drop in international confidence in the late 1980s. But it seems to have recovered since then.

Venezuela

As the sole member of OPEC in the Western hemisphere, Venezuela's fortune rises and falls with oil prices. The sharp peak in saving in the early 1970s was a direct result of the rise in the price of oil. Investment peaked with a delayed effect. The most striking feature is the huge gap between saving and investment in Venezuela. A gap of this magnitude over such long periods does not exist anywhere else in Latin America.

A brief review of literature

Feldstein and Horioka (1980) upset conventional wisdom by proclaiming that a high saving–investment correlation in pooled cross-sectional data of a number of (industrialized) countries implies capital immobility among them. This assertion holds under very restrictive theoretical conditions (see Frankel, 1992). Moreover, simulations with artificial economies have shown that high saving and investment correlation can persist even with perfect capital mobility (Baxter and Crucini, 1993; Finn, 1991). We deliberately refrain from drawing any conclusion based on pooled cross-sectional analysis of our datasets for the following reason: All the basic series exhibit unit roots. Gonzalo (1994) has shown that, in the presence of unit roots in the time-series data, none of the usual test statistics for the ordinary least square regressions has a standard distribution. Hence, any inference drawn from them are very likely to be erroneous, even with very large samples. Therefore, applying their argument in these data series seems entirely inappropriate.

Some recent studies have used modern time-series techniques to study the long-run relationship between saving and investment. Miller (1988) used seasonally adjusted quarterly data for the United States and found

that saving and investment were cointegrated for the period 1946–71, but not thereafter. The main interpretation of his result is that cointegration is associated with the period of the fixed exchange regime. None of the previous studies has explored the long-run relationship between saving and investment in Latin American countries using cointegration techniques. Latin American countries, over the period of our study, provide a testbed for studying economic crises using saving and investment because they have pursued fixed exchange rate policies. One of the problems with Miller's study is that filters used to adjust for seasonal patterns tend to distort the underlying properties of the data (see Davidson and Mackinnon, 1993, pp. 687–699). It is better to test for seasonal unit roots in such cases (see Franses, 1994; Hylleberg, Engle, Granger, and Yoo, 1990). Our study uses annual data. Hence, it does not suffer from the seasonality problems associated with unit roots.

Data and methodology

All data come from the *International Financial Statistics* (CD-ROM version, June 1996) of the International Monetary Fund. Annual data are used as follows: Colombia (1957–94), Dominican Republic (1950–95), Ecuador (1950–95), El Salvador (1951–95), Guatemala (1950–94), Honduras (1950–95), Jamaica (1950–93), Mexico (1950–94), Panama (1950–94), and Venezuela (1950–95). We follow the previous literature in defining gross domestic saving as gross domestic product minus total consumption (private plus government). This measure has been called “basic saving” by Baxter and Crucini (1993, p. 420). Gross fixed capital formation is taken as a measure of investment following earlier studies. Bayoumi (1990) points out that there is a distinct advantage in using gross fixed capital formation as a measure of investment because it is less prone to behave procyclically since it excludes the highly procyclical inventories component. The two variables considered are gross domestic saving and investment as percentages of gross domestic product. We call these variables SR and IR, respectively.

We use two types of unit root tests. The first is the Phillips-Perron (1988) test. The test is well suited for analyzing time series whose differences may follow mixed ARMA (p, q) processes of unknown order in that the test statistic incorporates a nonparametric allowance for serial correlation. The second test is an augmented Dickey-Fuller (ADF) test, which is an extension of the Dickey-Fuller test (see Dickey and Fuller, 1979, 1981).

The concept of cointegration is proposed by Granger (1981). Engle and Granger (1987) provide an axiomatic foundation of the methodology. Two (or more) $I(1)$ variables are said to be cointegrated if there is a linear combination of them that is stationary. Engle and Granger show that, if the variables are cointegrated, then the ordinary least squares (OLS) method gives superconsistent estimates. We use the Johansen-Juselius tests for cointegration (see Johansen, 1988; Johansen and Juselius, 1990, for details). Our results, however, have to be interpreted with caution. The unit root tests have low power (see Blough, 1992). The same applies for the Johansen-Juselius cointegration tests.

Results

The results of the Phillips-Perron unit root tests are in Table 1. The results indicate that both variables have unit roots for nine of the ten countries. Only for Dominican Republic are both variables stationary. For all other countries, both variables are found to be $I(1)$. Although we do not report the results, the ADF tests also yield the same qualitative results. Thus, we proceed with the cointegration tests within the Johansen-Juselius framework for all these countries with the finite sample correction proposed by Reinsel and Ahn (1992). To perform the correction, the trace statistic is multiplied by $(T - pk)/T$ where T is the number of observations, p is the number of variables, and k is the lag order in the VAR system. For annual data, lag of one or two is sufficient (see Pesaran and Pesaran, 1991). The reported results are for a lag of one. However, lags of two also produce the same qualitative results. The results are in Table 2. Although we do not report the results of the maximal eigenvalue tests, the results are the same with the maximal eigenvalue tests as well. Thus, our results are quite robust. The results indicate that for Ecuador, Honduras, Jamaica, and Panama, SR and IR are cointegrated. In all four cases, the number of cointegrating vector is equal to one.

For the other five countries, the two variables are not cointegrated (recall that, for Dominican Republic, SR and IR are not integrated). Thus, in these five countries the ratios may drift apart. Therefore, our results indicate that Colombia, El Salvador, Guatemala, Mexico, and Venezuela would be more prone to sudden crises of currency or balance-of-payment problems resulting in macroeconomic adjustment problems such as high real interest rate or high inflation or both. The history of the past half-century tells us that these are precisely the

Table 1
Phillips-Perron unit root tests for savings ratios and investment ratios

	SR		IR	
	Test statistic	Critical value	Test statistic	Critical value
Colombia	-2.5226 ^a	-2.9422	-2.6720 ^a	-2.9422
Dom. Rep.	-3.3548 ^a	-2.9271	-3.4784	-3.5112
Ecuador	-2.5812	-3.5112	-2.0760	-3.5112
El Salvador	-2.6632	-3.5136	-2.6176	-3.5112
Guatemala	-1.9957 ^a	-3.9286	-2.5126	-3.5136
Honduras	-2.3994	-2.9271	-2.4276	-3.5112
Jamaica	-2.5683	-3.5162	-2.2357	-3.5162
Mexico	-0.8907	-3.5136	-1.9976	-3.5136
Panama	-2.2039 ^a	-2.9286	-1.7773 ^a	-2.9286
Venezuela	-2.8861	-3.5112	-1.8292 ^a	-2.9271

^aIndicates no trend.

Critical values at the 5% level are from Mackinnon (1991). The lag of 3 was determined using the Schwert (1989) criterion.

Table 2
Trace tests for cointegration between saving and investment

	Null: $r = 0$		Null: $r \leq 1$	
	Test statistic	Critical value*	Test statistic	Critical value*
Colombia	12.1279	17.8520	4.29216	7.5250
Ecuador	17.6074**	15.6630	2.0219	6.5030
El Salvador	6.0971	15.6630	2.7686	6.5030
Guatemala	14.9376	17.8520	3.5778	7.5250
Honduras	17.9495**	17.8520	1.4158	7.5250
Jamaica	17.7299**	15.6630	4.2755	6.5030
Mexico	14.6246	15.6630	3.4936	6.5030
Panama	24.5464**	17.8520	3.2754	7.5250
Venezuela	13.9698	17.8520	1.3423	7.5250

* Critical values are for the 90% quantile. These are from Osterwald-Lenum (1992).

** Significant at the 10% level.

countries where such problems did occur.

Table 3 gives the normalized long-run cointegrating vectors for these four countries. In all four cases the signs of the coefficients are as expected. The two variables have a long-run equilibrium relationship. The magnitudes of the coefficients of the vectors are fairly close to $(-1, 1)$.

Table 3
Long-run cointegrating vector (β) between saving and investment

	SR	IR
Ecuador	-1.000	1.0167
Honduras	-1.000	0.8468
Jamaica	-1.000	1.0886
Panama	-1.000	0.7667

Coefficients are normalized on SR.

Summary and conclusions

In this paper we tested the Feldstein-Horioka hypothesis of saving–investment equality using the cointegration methodology. First, we tested for unit roots. We found that, except for Dominican Republic, saving and investment ratios of other nine countries have unit roots. Tests show that both variables are $I(1)$ for these nine countries. We proceed with the cointegration tests using the Johansen-Juselius framework. We use the finite sample correction to adjust our test statistics. The results show that saving and investment ratios have a long-run relationship for only four out of ten countries. For all four countries, we find that the number of cointegrating vectors is equal to one. The vectors show that there is a long-run positive equilibrium relationship between the two variables. We normalize the vectors with respect to the saving rate and find that the magnitude of the investment coefficients is fairly close to one. For the five other countries, the divergence between saving rate and investment rate may result in macroeconomic instability in the long run.

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