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Financial Developments and the Saving-Investment-Growth Nexus: *Evidence from the Caribbean and Latin America*

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Financial Development and the Saving-Investment-Growth Nexus: Evidence from the Caribbean and Latin American

by

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Abstract

This study addresses two separate but intimately related issues in the growth and finance literature: the finance-growth nexus, specifically the causal relationship between financial development and economic growth, and the saving-investment-growth nexus, which looks at the causal links between these three aggregates. Hence, we are asking, what are the causal relationships between saving, investment and growth and are these influenced by the level of financial development? In tackling these issues, we construct three indicators of financial sector development based on measures of the relative size of the financial sector, the absolute size, and the activity of financial intermediaries. We also combine these into an overall measure of financial development and use this to classify the countries of Latin America and the Caribbean accordingly. The analysis is also augmented with two measures of stock market development. Next we investigate the causal chains between saving, investment and growth using cointegration analysis and after that evaluate the results within the context of our previous classifications. Our results indicate that the causal relationships between saving, investment and growth vary across the countries and, by extension, the finance-growth relationship. Moreover, we did not find any evidence to suggest that these are fashioned by the level of financial development.

JEL Classification: C22; E21; F41; O11; O57;

1. Introduction

Growth theories, in particular the various neoclassical growth models, posit a close association between domestic saving, investment, and growth. They argue that government policies can, by altering the saving rate, stimulate higher levels of investment, which will ultimately promote economic growth. This is also one of the main premises of the financial liberalisation thesis: that the removal of the various constraints on the financial system will encourage higher saving, which will lead to more investment and hence growth. There are three hypotheses in this argument: financial liberalisation policies impact positively on saving decisions; a rise in saving leads to an increase in investment; and more investment results in faster economic growth.

In this paper, we are particularly interested in the second and third hypotheses; indeed the second remains the most controversial in the literature. At the centre of the debate is the question of 'causation': whether there exists any and if so in what direction. Specifically, whether it is saving that causes investment, leading to growth, or investment that drives saving and growth. In fact, the literature also suggests a causal chain from growth to saving and investment. Higher growth raises the saving rate which, in turn, provides the resources necessary to sustain growth through higher investment.

Apart from the implications for the effectiveness of any liberalisation programme, the direction of causality has been significantly linked to the debate on fiscal policy. If causality does run from saving to investment and growth, then raising the rate of investment requires increased national saving and this calls for self-restraint on the part of both government and households. In fact, a belief that this is so forms part of the justification behind the recommendations to developing countries by the IMF, World Bank and others of fiscal austerity measures in times of balance of payments or other difficulties. Indeed, it also implies that the deficit should be cut via expenditure policies rather than taxes. The reasoning is that an increase in taxes would lower household income and hence reduce household saving, thereby offsetting the benefits of the lower deficit on total saving. Policies should therefore be focused on encouraging saving through tax breaks and other incentives. On the other hand, if one believes that it is

investment that is the prime mover, then the problem is how to get businesses to increase their investment spending, and policies should be geared towards raising both the level and efficiency of investment. Yet if causality runs from growth to saving or investment, as many empirical studies have reported (for example, Carroll and Weil, 1994), the policy efforts should be directed at removing any impediments to growth. Although there is a large body of empirical literature examining the correlation between these aggregates, very few studies have dealt with the issue of causality and even fewer have examined the relationship for developing countries.

The saving-investment-growth nexus is also at the centre of the finance-growth debate, in which there is a large literature examining whether financial development leads, follow or is unimportant for growth. Most of the empirical work on the finance-growth hypothesis usually construct some indicators of financial development and investigate their relationship with growth. However, as we will discuss in the next section, the channels through which financial development impacts on growth are saving and investment, and given the problems associated with accurately measuring financial development, we take a slightly different approach to the causality analysis. First, we use traditional measures of financial development to classify the countries accordingly. We then examine the causal chains between saving, investment and growth using cointegration analysis and evaluate the results within the context of our prior classifications. This allows us, not only to address the issue of the saving-investment relationship but also to deal with that of finance-growth. The rest of the paper is organised as follows: The next section contains a sketch of the theoretical and empirical literature and in section 3 we construct measures of financial development and attempt to classify the countries of LAC. Section 4 presents the causality analysis for saving, investment and growth, while section 5 discusses the results in terms of financial development. Section 6 presents some concluding remarks.

2. The Impact of Financial Development

There is a large theoretical and empirical literature discussing the importance and nature of the relationship between financial development and economic growth[2], which can be traced as far back as Bagehot (1873) and Schumpeter (1912). In this regard, two dominant views emerge from the literature. The first, often referred to as 'supply-leading', is where financial institutions are created before the demand for their services is evident, in which case financial development leads to faster growth. The second view, termed 'demand-following', regards financial development as accommodating or reacting passively to the growth of the real economy. Both however lead to the conclusion that there is a strong link between financial development and economic growth. Furthermore, it also implies that the more developed the financial system is the more it is able to attract savings and also provides greater opportunities for those savings to be channeled in to profitable investment projects. Hence, the greater financial development implies a stronger link between saving, investment and growth.

The supply-leading view postulates that the financial system, through its intermediation role, affects economic growth through its impact on capital accumulation (including human as well as physical capital) and through its impact on the rate of technological progress. Market frictions, including informational asymmetries and transaction costs, allow the emergence of financial markets and intermediaries that provides five basic functions: mobilisation of saving, allocation of resources, hedging and pooling of risks, easing exchange of goods and services, monitoring managers and exerting corporate control (Levine, 1997). In fulfilling these functions the financial system affects the rate of capital accumulation either by altering the saving rate or by reallocating the available savings among different investment projects. This effect is captured in growth models of Romer (1986), Lucas (1988) and Rebelo (1991). The technological innovation effect is at the centre of growth models that focus on the invention of new production processes and goods (Romer, 1990; Grossman and Helpman, 1991; and Aghion and Howitt, 1992 are examples of such models).

[2] See Pagano (1993) and Levine (1997) for expositions of the theoretical relationships and Demetriades and Andrianova (2003) for a survey of the empirical literature.

This leading role assigned to finance in the growth process is also at the heart of the liberalisation thesis as popularised by McKinnon (1973) and Shaw (1973). They posited that interest rates deregulation would induce savers to save more and thereby expand the supply of credit available to domestic investors. This would raise the level of investment and also, by channelling funds towards the financing of more productive projects, result in faster economic growth. Growth is further enhanced if the cost of intermediation by banks is kept low by having a competitive banking structure, minimum taxation on financial intermediation and a well-functioning stock market. With respect to the stock market, apart from its role in improving the efficiency of resource allocation, it can help to ease risk especially liquidity risk and therefore encourage greater investment. Liquid equity markets make long-term investment more attractive because they allow savers to liquidate quickly and cheaply if they need access to their savings, while allowing companies to enjoy permanent access to capital raised through equity issues. Hence, through its role of providing longer-term, more profitable investments, liquid markets improve the allocation of capital and thereby increase economic growth.

The supply-leading hypothesis therefore suggests that empirical work should find causality runs from financial development to the real economy. It also implies that causality runs from saving and investment to growth and that this relationship should be stronger the more developed the financial system is.

On the other hand, the demand-following view regards financial development as a consequent of the demand for financial services (see for example, Robinson, 1952; and Lucas, 1988). As the economy moves from traditional subsistence production, grows more complex, and generally becomes monetised, certain demands are generated for the services of financial institutions. Such demands are created by the growing needs of firms for external finance, as their retained profits fall short of their investment expansion needs. Hence, financial development follows economic growth and has little

effect on it. Therefore, it is growth in the real economy that causes financial development and, by extension, saving and investment.

Gupta (1984) is one of the earlier studies to explicitly address the issue of causality utilising the Granger framework. In examining the relationship between broad money (a proxy for financial development) and industrial production (a proxy for economic growth), Gupta concludes that financial development causes growth. However, although his empirical analyses is considered to be an important step in causality testing, it is also seen as studying the money effects on industrial production more than financial aspects of economic growth (Demetriades and Hussein, 1996).

Another important study is that of Jung (1986), which addresses the issue of causality within a vector auto-regressive (VAR) framework. Jung reports evidence in favour of a causal influence from financial development to the real economy for developing countries and the reverse for developed countries. His sample of developing countries includes Argentina, Chile, Honduras, Uruguay and Venezuela. Among this group Jung finds causality from economic growth to financial development in the case of Venezuela, while the opposite direction for Argentina and Chile: financial sector development lead to growth. He did not find any significant causal relation for Honduras or Uruguay. Jung's results are however undermined by the fact that VAR approach is valid only if the variables are *I(0)* (which is highly unlike since they are in levels (Demetriades and Hussein, 1996)), otherwise cointegration analysis is necessary.

One of the most cited works in the recent empirical literature is that of King and Levine (1993) who study 80 countries over the period 1960 – 1989, using four different measures of financial development (liquid liabilities divided by GDP, bank credit divided by bank credit plus central bank credit, claims on the non-financial private sector divided by domestic credit, and claims on the private sector divided by GDP) and cross-section techniques. They test whether the initial value of financial depth helps to predict the rate of economic growth and conclude that it does, even after controlling for other factors that may affect these variables. However, Demetriades and Hussein (1996) argue that,

given the inherent problems associated with cross-sectional techniques (including the unrealistic assumption that each country has a stable growth path) plus the difficulty of interpreting causality within cross-country data sets, it is best to address causality from a time-series perspective (Andersen and Tarp, 2003, also argues strongly in favour of time-series and cointegration analysis).

In this regard, Demetriades and Hussein (1996) became one of the earliest studies to use time-series and cointegration analysis to examine the causal relationship between financial development (using two different measures – bank deposit liabilities to GDP and the ratio of bank claims on the private sector to GDP) and economic growth. The authors use data on 16 developing countries (including 5 from Latin America – Costa Rica, El Salvador, Guatemala, Honduras and Venezuela) over the period 1960-1990. They find a cointegrating relationship between the indicators of financial development and real per capita GDP in 14 countries (including the 5 from LA). However, they conclude that the direction of causality varies significantly across countries and also depends on which indicator of financial development is used. They find bi-directional causality in seven countries (which includes Guatemala, Honduras and Venezuela) and evidence of growth causing financial development in six cases (one of which is El Salvador) but no evidence of finance lead growth for any of the countries.

The results of Demetriades and Hussein are at variance with an earlier study by De Gregorio and Guidotti (1995), who report a negative causal relationship running from financial development and growth in a panel of twelve Latin American countries[3]. Similarly, Xu (2000) also reports a negative causal (long-term) relationship from financial development to the real economy for 14 of the 41 developing countries in her study, including Costa Rica and Trinidad and Tobago. Xu's study differs from the others

[3] There is a view in the theoretical literature that supports the idea that financial development is neither necessary nor sufficient for growth in developing economies and can actually have a negative impact (Gurley, 1967a, 1967b; Van Wijnbergen, 1983; and Buffie, 1984). The argument is that in the presence of informal curl markets the development of financial institutions can actually retard growth by reducing the availability of credit to domestic firms. As the formal financial system develops, households are enticed to substitute out of the informal market loans or cash to increase their holdings of interest bearing deposits and, since banks are subject to reserve requirements and the curb markets are not, there is a reduction in funds available to firms. Hence, lower investment and slower growth.

in that it also utilises impulse-response analysis to gauge the effects of one-time shocks to the individual indicators of financial development. Interestingly, Xu finds a positive affect of financial development on growth for Jamaica and a number of other Latin American countries.

The above discussion therefore suggests that caution should be exercised in drawing conclusions and making generalisations about the causal relationship between financial development and the real economy. The likely relationship between the two sectors appears to be country-specific and must be examined on a case by case basis. Interestingly, empirical studies on the relationship between financial development and growth typically construct a number of proxies of the former (usually monetary aggregates) and econometrically analyse their relationship with the latter. However, given that financial development is not easily measurable (Gelbard and Leite, 1999; and Levine *et al.*, 2000 discusses some of the issues and limitations with such measures) plus the fact that saving and investment are the channels through which financial development affects growth, we take a somewhat different approach to analysing the causality issue in LAC. First, we attempt to classify the countries into levels of financial development using some of the traditional measures. Then we examine the causal chains between saving, investment and growth (since there is less uncertainty with the measurement of these aggregates) and subsequently endeavour to draw conclusions from the results based on our prior classifications.

3. Financial Development in LAC

This section attempts to assess the level of financial development in the LAC region by evaluating five indicators commonly used in the literature: three relating to banking sector development and two to the stock market. We employed a standard statistical tool, principal component analysis (PCA), to construct an overall index of the banking sector indicators as a measure of the level of financial sector development in each country. However, given the limitation of the data of stock market development it was not included in the overall index but used as a guide to our conclusions. We do believe

that our approach is appropriate since these economies are more banking sector-based as opposed to capital market-based.

As noted by Levine *et al.* (2000) and others, it is difficult to construct accurately measures of financial development to compare across countries and over time. Bandiera et al. (2000) argues that the ideal indicator would be one that captures both the various aspects of the deregulatory and the institution-building process in financial sector development. They however concede that this is next to an impossible task. Nevertheless, we believe that the indicators chosen will allow us to capture, with a reasonable degree of confidence, the evolution of countries' financial sectors since they focus not only on size but also on the activity of financial intermediaries. Furthermore, by combining the indicators into a single measure we are effectively reducing any biases or errors that may be associated with any individual indicator. In addition, we draw on the database of Beck *et al.* (1999), which provides relatively consistent measures of financial development across countries, and update where necessary using the IMF's International Financial Statistic (CD Rom July, 2004) and the World Development Indicators (CD Rom 2003).

3.1 Measuring Financial Development

The first indicator, Liquid Liabilities to GDP (*LLY*), measures the size of the financial sector relative to the economy and is often referred to as an indicator of financial depth. It is the broadest measure of financial intermediation since it includes all three financial sectors (Central Bank, Deposit Money Banks and other Non-Bank Financial Institutions) and is calculated as the ratio currency plus demand and interest bearing liabilities of banks and other financial intermediaries to GDP. It has been used extensively in empirical work (see for example McKinnon, 1973; King and Levine, 1993; Beck *et al.*, 1999; and Levine *et al.*, 2000) as is believed to be positively correlated with quality and level of financial services provided. It should however be noted that, on its own, this measure could lead to erroneous conclusion since it does not differentiate between allocation to private and public sector entities. So that a financial system that is channelling most of its credit to state owned enterprises maybe classed as having a

developed financial system, when in fact it is failing in its role to efficiently allocate resources.

The second indicator of financial development, Deposit Money Bank Assets to Central Bank Assets (*B-CB*), measures the relative importance of banks versus the central bank in the financial system. It is calculated as the ratio of deposit money banks assets and the sum of deposit money and central bank assets. The intuition behind this measure is that banks are better able to execute the basic functions of the financial system (such as the allocation of resources, the mobilisation of financial savings and the evaluation of potential returns and risks of investment projects) than the central bank. Thus, it is expected that banks and other financial institutions will gain relative importance as the financial sector develops.

The final indicator, Private Credit by Deposit Money Banks and other financial institutions to GDP (*PCY*), is a measure of the activity of financial intermediaries in one of their main functions; channelling savings to investment. It captures credit to the private sector as opposed to credit to the public sector and concentrates on that issued by intermediaries other than the central bank. The assumption behind this measure is that financial systems that provide more private sector credit are doing more towards the mobilisation of savings and the facilitation of transactions than those that simply provide credit to the government and public sector.

Table A-1 (in Appendix) presents some descriptive statistics for the three indicators with respect to Latin America and the Caribbean. It shows that each indicator is on average higher in the Caribbean than in Latin America and also exhibits less variability over the sample period. Hence, one can infer (though with extreme caution since these are averages over a long period) that the financial systems of the Caribbean appear to be more developed than those of Latin America. Loayza and Palacios (1997) arrive at the same conclusion for the period 1985-95.

Since these indicators are capturing different, but overlapping aspects of financial development, we construct an index of overall financial sector development (*Index*) for each country, as is commonly done in the literature (see for example Demetriades and Luintel, 1996 and 1997; Bandiera *et al.*, 2000; and Abiad and Mody, 2003), using the first principle component[4]. The intuition behind PCA is that since each of the above indicators is capturing some aspect of financial development, then the indicator that has the highest correlation with the other indicators should be considered as the most accurate indicator of financial development. Therefore, by examining the statistical correlations between the different indicators and assigning weights to reflect the level of correlation uncovered, it is possible to combine the individual indicators into a composite index. The results of the PCA are presented in Table A-2 (in Appendix). The *Eigenvalues* column gives the eigenvalues in order of size. The *Variance Proportion* column indicates how much of the total variation in the variable can be explained by the first, second and third principal component. The *Eigenvector1* column displays the eigenvector corresponding to the first eigenvalue and the overall indicator (*index*) is computed as a linear combination of the individual indicators weighted by this vector. What we are particular interested in knowing is how much of the total variation can our index, the first principal component, explain. The more it can explain the greater confidence we can place in our combined indicator.

For all the countries, the first principal component accounts for a high proportion of the total variation: more that 66% except in the case of Mexico and Peru and even in these two cases the percentage is above 50. Table A-3 (in Appendix) contains the correlation statistics for the four indicators and shows that in every case *Index* is highly correlated with the other indicators. The *index* along with the other indicators for each country is presented in Figures 1 and 2 for the four larger Caribbean countries, Figures 3 and A-1 for the OECS, and Figure A-2 for Latin America. In each case, *index* is plotted on the right axis and the others are measured on the left axis.

[4] The method of principal component (Lawley and Maxwell, 1971; and Theil, 1971) involves the linear and orthogonal transformation of our set of correlated variables, *B-CB*, *LLY* and *PCY* in to three uncorrelated variables referred to as the first, second and third principal components (*Index*, *Index1* and *Index2*). These are ordered in terms of variance. The process involves finding the eigenvalues and vectors of either the covariance or the correlation matrix.

3.2 Financial Development in the Region

Figures 1 and 2 indicate that the four larger Caribbean countries have experienced relatively similar patterns of evolution in financial development: making the most strides in the 1980s and 1990s. In the case of Barbados, all the indicators started rising at the beginning of the 1980s and have continued trending upwards. In this regard, Craigwell *et al.*, (1994) note the 1980s was marked by the entrenchment of the non-bank financial institutions (NBFI) in the Barbadian financial system, who more than doubled their share of deposits and loans contributions between 1980 and 1990. Craigwell and Bynoe-Mayers (2002) conclude that Barbados was minimally developed up until 1986, but since then may be described as somewhat developed.

The financial system of Trinidad and Tobago also experienced rapid growth during the 1980s although linked to different factors. Forde *et al.* (1997) attribute this to the wide-sweeping reforms initiated by the Central Bank of Trinidad and Tobago following the collapse of many NBFI at the begin of the 1980s (as many of the sectors supported by the NBFI contracted).

The Jamaican financial system showed a significant level of expansion between 1960 and 1975 as reflected in the *LLY* and *PCY* indicators. However, unlike to Barbados and Trinidad and Tobago, this period also featured a falloff in banking activity relative to the central bank (captured by the B-CB indicator) which lasted up to the mid-1980s. Peart (1995) refers to this as a period of "strong financial repression" characterised by strong public sector leadership, government involvement in the operation and development of financial institutions, bureaucratic controls on entry, and the dominance of commercial banks in the financial intermediation process. Banking sector activity picked-up in 1986 as the government implemented policies aimed at liberalising the financial sector as part of a structural adjustment program with the World Bank, which was designed to create an environment conducive to efficient financial intermediation. Unfortunately, following the onslaught of Hurricane Gilbert all such policies were reversed, but later re-implemented in 1991. This is captured adequately by the decline in the overall indicator in 1989, which then picked up in the mid-1990s.

Figure 1:

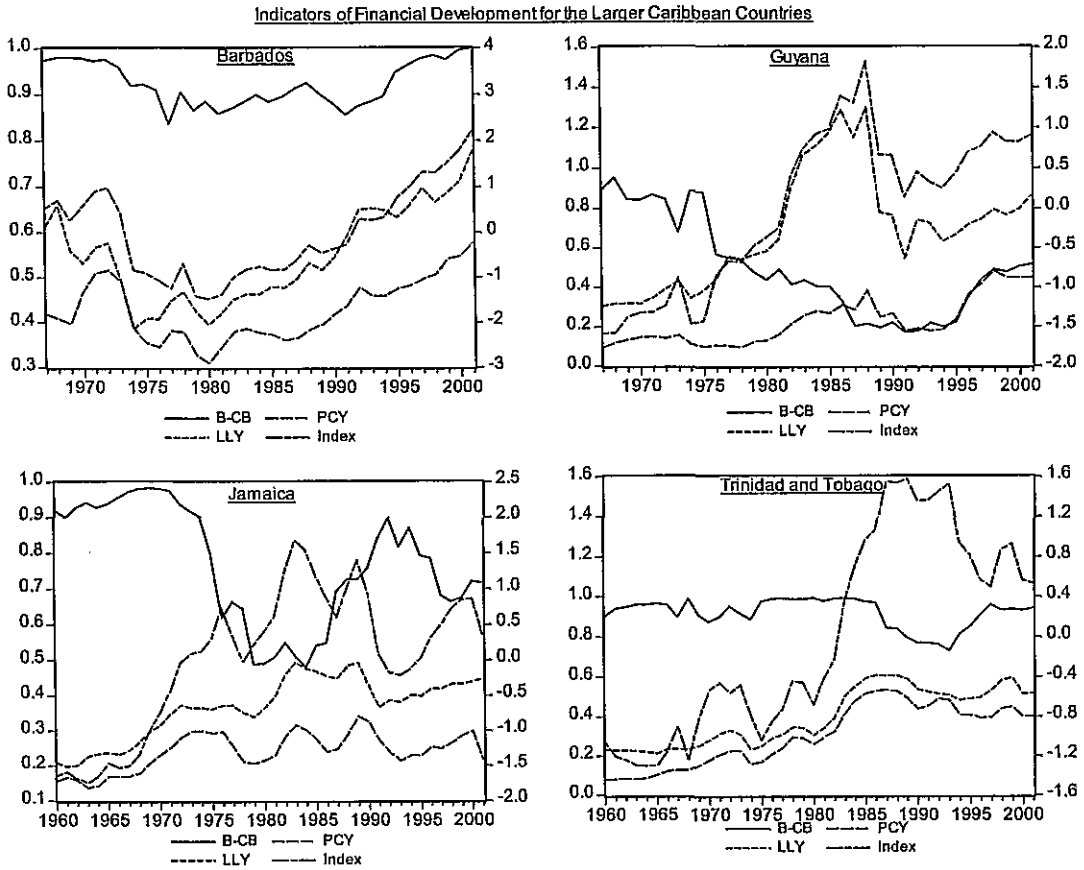
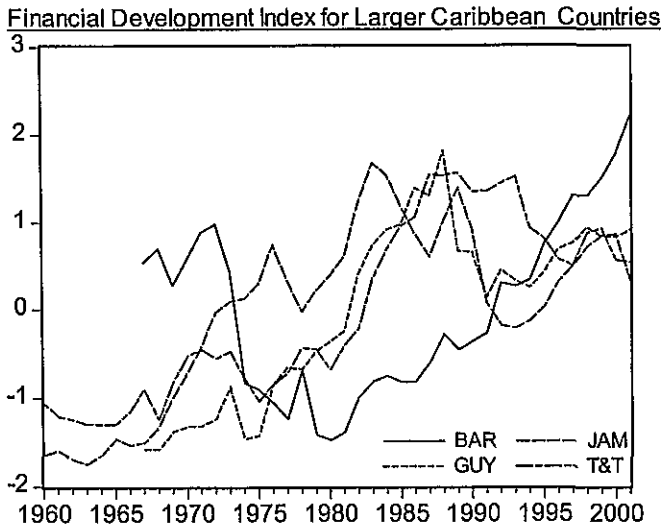


Figure 2:



The evolution of Guyana's financial system is somewhat similar to that of Jamaica. Prior to 1988 the *LLY* and *PCY* indicators both trended upwards, while there was a drastic decline in banking sector activity (a significant falloff in the B-CB indicator over the same period). El-Hadj (1997) argues that State-control was of a far greater proportion in Guyana that in any other Caribbean country and much of the lending was directed to specific sectors (deemed not either not profitable or too high risk by private banks) and done state control banks and other public institutions. In 1988, the government embarked on an Economic Recovery Programme aimed at liberalising the financial sector and stimulating greater financial intermediation. This is reflected in the four indicators, which have all trended upwards during the 1990s.

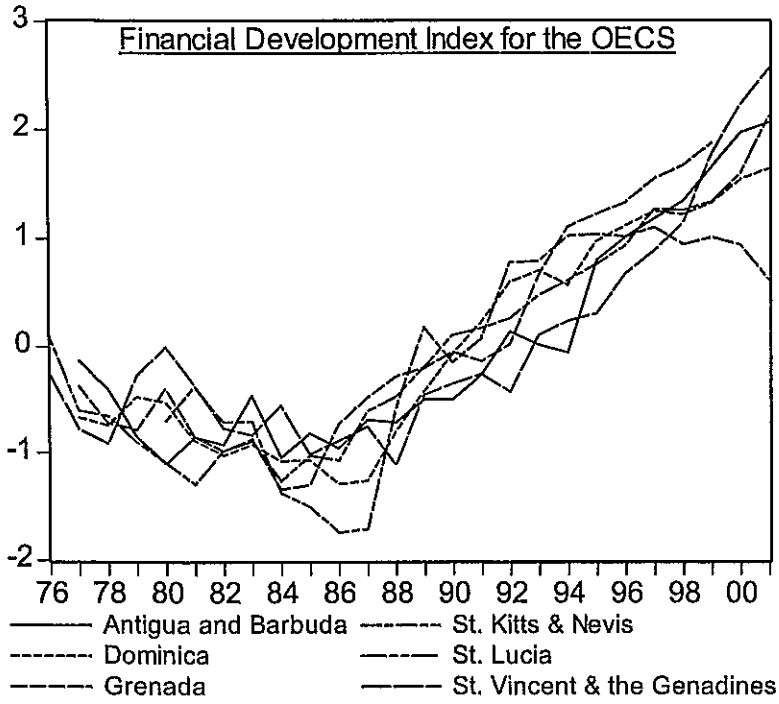
Unlike the four larger Caribbean countries, there is greater commonality in evolution of the financial systems of the OECS, as depicted in Figure 3 (*index*, along with the other individual indicators for each country of OECS are given in Figure A-1 in the appendix), and this is to be expected since they have all been part of a monetary union since 1965 (first as part of the Eastern Caribbean Currency Authority from 1965-1982 and then the Eastern Caribbean Central Bank[5] - ECCB). The four indicators for the individual countries show a consistent level of financial development following the establishment of the ECCB and this is even more pronounced for the 1990s. Anthony-Brown and Samuel (1997) note that 1991-1995 corresponds to an active period of financial development fuelled by the ECCB orchestrated development of money and capital markets and the passage of the Uniform Banking Act (which created a single financial space).

Figure A-2 contains the four indicators for the Latin American countries and suggests that although there are ample differences in the extent of financial development among the countries, there appears to be three patterns in the data. The first is where there has been an upward trend in financial development over the sample period with a significant

[5] We have only been able to obtain consistent data for the OECS from the mid-1970s.

contraction in the 1980s[6]. This pattern is evident in the cases of Chile, Colombia, Dominican Republic, Guatemala, Honduras and Paraguay and we consider this group as the more advance in the region. The second pattern, which can be seen in Argentina, Brazil, Ecuador and Peru, is where there have been very little gains in financial development prior to the 1990s but then a significant takeoff between 1990 and 2001. The commonality between the two patterns is of course the improved position in the 1990s and in this regard it is interesting to note that in the early nineties, virtually all the Latin American countries liberalised their financial system and lifted all capital controls (see Demirguc-Kunt and Detragiache (1998b) for liberalisation dates). The third pattern is where the financial system never fully recovered from the "lost decade" or took another decade to do so. Costa Rica, El Salvador, Uruguay and Venezuela fit this pattern.

Figure 3:



[6] The eighties for Latin America are often referred to as the "lost decade" and featured a number of banking and currency crises in the region (Demirguc-Kunt and Detragiache, 1998a and 1998b, provide dates for these crises).

3.3 Classifying the Levels of Financial Development

In keeping with the standard practice of smoothing indicators in order to focus on trends, we average the *index* variable for each country over 10-year periods. Then, using the 1990s average for each country we classify a country based on its deviation from the sample mean[7]. The results are presented in Table 1 and are consistent with

Table 1 Level of Financial Development

Country	Period Averages				Classification
	1960s	1970s	1980s	1990-01	1990-01
Larger four Caribbean Countries (LFCC)					
Barbados	0.50	-0.33	-0.84	0.85	Medium-High
Guyana	-1.51	-1.03	0.76	0.60	Medium-High
Jamaica	-1.51	0.06	1.05	0.34	Low-Medium
Trinidad and Tobago	-1.15	-0.63	0.64	0.95	Medium-High
LFCC average	*-0.92*	*-0.48*	*0.40*	*0.69*	
OECS					
Antigua & Barbuda	NA	-0.46	-0.80	0.79	Medium-High
Dominica	NA	-0.63	-0.93	0.93	Medium-High
Grenada	NA	-0.62	-0.74	0.93	Medium-High
St. Kitts & Nevis	NA	NA	-0.92	0.77	Medium-High
St. Lucia	NA	-0.52	-0.89	0.91	Medium-High
ST. Vincent & Grenadines	NA	-0.56	-0.67	0.75	Medium-High
OECS average		*-0.56*	*-0.83*	*0.85*	
Caribbean average	*-0.92*	*-0.52*	*-0.33*	*0.78*	
LATIN AMERICA					
Argentina	-0.32	0.24	-0.58	0.53	Low-Medium
Brazil	NA	NA	-0.70	0.59	Medium-High
Chile	-0.82	-1.12	0.53	1.11	High
Colombia	-0.83	-0.49	-0.05	1.15	High
Costa Rica	1.19	0.64	-1.13	-0.58	Low
Dominican Republic	-1.43	-0.02	0.28	0.97	Medium-High
Ecuador	-0.57	-0.36	-0.21	0.95	Medium-High
El Salvador	0.05	0.72	0.69	-1.21	Low
Guatemala	-1.24	-0.36	0.70	0.75	Medium-High
Honduras	-1.32	0.08	0.23	0.84	Medium-High
Mexico	0.51	0.53	-1.22	0.15	Low-Medium
Paraguay	-1.20	-0.13	-0.05	1.15	High
Peru	0.18	0.27	-0.81	0.30	Low-Medium
Uruguay	-0.65	-0.85	0.78	0.60	Medium-High
Venezuela	-0.66	0.85	1.81	-1.66	Low
Latin America average	*-0.51*	*0.00*	*0.02*	*0.38*	
Sample average	***-0.62***	***-0.22***	***-0.10***	***0.54***	

[7] A country is considered as having a low-medium level of financial development if its *index* value falls between 0 and the sample mean (which is 0.54), a medium-high level if the value lies between the sample mean and 1, a high level if it is above 1, and a low level if it is below 0. We should stress that this

the above discussion.

Among the four larger Caribbean countries, Trinidad has the most developed financial system and although it is classified as being *medium-high*, it borders close to the *high* group. Jamaica attains the lowest (*low-medium*) classification for that group, which is a reverse from it position in the 1980s. As expected, the OECS are all classified as *medium-high*. The Latin American results are more varied as would be expected from the above discussion. Chile, Colombia and Paraguay are all classed as having the most advanced financial systems in the region, while Brazil, Dominican Republic, Ecuador, Guatemala, Honduras, and Uruguay are ranked as *medium-high*, although Brazil's score is very close to the *low-medium* group containing Argentina, Mexico and Peru. At the lower end of the classification are Costa Rica, El Salvador and Venezuela. Although we have been unable to find similar studies for the region which we could use for comparison, our results are consistent with discussions in Loayza and Palacios (1997) and Herrero *et al.* (2002).

3.4 Stock Market Development

As noted earlier, the indicators of financial development analysed above all focus on the banking system and is often referred to in the literature as banking system indicators. Therefore, the question naturally arises concerning the stock market development and how that has fared in the region. However, in this regard it should be noted that these economies, especially those of the Caribbean are predominantly banking sector based as opposed to capital market based in that most of investment financing comes from the banking sectors as opposed to the stock markets. In fact, it is only within the last two decades that a stock market was established in some of the countries in the region; Trinidad and Tobago in 1981, Barbados in 1987 and the OECS in 2001.

In discussing stock market developments we focus on two measures, the stock market capitalisation to GDP ratio (*CY*) and the stock market turnover ratio (*TOR*). The first

approach is very subjective and is not utilise in any way in the econometrics analysis but is simply to aid in discussing the causality results.

measure the value of listed shares divided by GDP and is an indicator of the size of the stock market. The second measure, *TOR*, is defined as total value traded divided by total market capitalisation and is considered to be an indicator of stock market efficiency (Beck *et al.*, 2000). It measures the activity or liquidity of a stock market relative to its size: a small but liquid stock market will have a high *TOR* but a small *CY*. Moreover, Rajan and Zingales (1998) argue that since *TOR* also incorporates the forward-looking behaviour in both numerator (total trading value of stocks) and denominator (stock market capitalisation), an increasing *TOR* indicates a more developed stock market rather than a more optimistic one.

Figures A-3 and A-4 show the *CY* and *TOR* indicators, respectively, for the Caribbean countries, while the corresponding ones for Latin America are given in Figures A-5 and A-6. The *TOR* indicator suggests that there has been a convergence of the three Caribbean stock markets in terms of size. From the start of nineties, the Jamaican stock market has been shrinking in size and only began to expand again in 1995, while that of Trinidad and Tobago and Barbados (still in its infancy) experienced the reverse over the period. In terms of liquidity, the stock markets of Jamaica and Trinidad and Tobago have exhibited similar patterns of evolution: fluctuating around an upward sloping trend prior to 1995, after which they declined and settled around 0.04. Activity on the Barbados stock market has always been low and remains so to date. Among the Latin American countries, Chile has the largest stock market, while Uruguay and Venezuela have the smallest. However, in terms of activity, Chile shares the lower ranks with Colombia and Uruguay, while the more active capital markets in that region are in Brazil, Mexico and Venezuela.

4. Empirical Analysis of the Saving-Investment-Growth Nexus

In section, we examine the following causal relationships; saving-investment, saving-growth, and investment-growth in LAC using two approaches to cointegration; the Johansen (1988 and 1995) maximum likelihood estimation (MLE) framework and the autoregressive distributed lag (ARDL) approach (Pesaran and Shin, 1999; Pesaran et al., 2001). The reason for employing both techniques is that although the MLE is the

most common procedure in the literature, it tests for the absence of long-run relationships under the restrictive assumption that the variables are integrated of order 1, *I(1)*, However, if any of the regressors are *I(0)* or fractionally integrated then statistical inferences from the trace and maximum eigenvalue tests are unreliable because the likelihood testing procedure for the cointegrating rank can be sensitive to the presence of stationary variables (Harris, 1995; Rahbek and Mosconi, 1999). Hence, there must be certainty as to the order of integration of the underlying variables prior to proceeding with the analysis. The added value of the ARDL is that it allows testing for cointegration irrespective of whether the regressors are purely *I(0)*, purely *I(1)* or mutually cointegrated. Therefore we use both procedures to investigate the long- and short-run causal relationships between domestic saving, domestic investment and economic growth for the individual countries. The Johansen MLE is the first choice; however, in the event that there is uncertainty concerning the stationary properties of the series the ARDL is utilised.

4.1 Econometric Methodology

Johansen MLE Framework

The Johansen MLE framework begins with a vector autoregressive (VAR) representation of the form:

$$x_t = \eta + \sum_{i=1}^{p} \Pi x_{t-i} + \varepsilon_t \qquad (1)$$

where x is an $n \times 1$ vector of variables, some of which may be I(1) or I(0), η is an $n \times 1$ vector of deterministic variables, Π is an $n \times n$ coefficient matrix and ε is an $n \times 1$ vector of disturbances with normal properties. If there exists a cointegrating relationship among the I(1) variables, Equation 1 may be reparameterised into a vector error correction model (VECM):

$$\Delta x_t = \eta + \sum_{i=1}^{p-1} \Phi_i \Delta x_{t-i} + \Pi x_{t-1} + \varepsilon_t \qquad (2)$$

where Δ is the first difference operator, and Φ is an $n \times n$ coefficient matrix. The rank, *r*, of Π determines the number of cointegrating relationships. If the matrix Π is of full rank (*n*) or zero, the VAR is estimated in levels or in first differences respectively, since

there is no cointegration amongst the variables. However, if the rank of Π is less than n then there exist $n \times r$ matrices β (the cointegrating parameters) and α (the adjustment matrix, which describes the weights with which each variable enters the equation) such that $\Pi = \alpha\beta'$, and equation 2 provides the more appropriate framework. The Π matrix is estimated as an unrestricted VAR and tested as to whether the restriction implied by the reduced rank of Π can be rejected.

The test statistics for determining the cointegrating rank of the Π matrix are the trace statistic given by

$Q_t = -T \sum_{i=T-1}^{k} \log(1-\lambda_i)$, for $r = 0,1,...,k-1$ and λ_i = the i^{th} largest eigenvalue

and the maximum eigenvalue statistic, which is given by

$Q_t = -T \log(1-\lambda_{T-1}) = Q_T - Q_{T+1}$

The issue of the causal relationship between the variables can be tested through an examination of the Φ_i and α in equation 2. Specifically, if Δx_{it} fails to respond to the defined long-run disequilibrium, i.e. $\alpha_i = 0$, then x_{it} is said to be weakly exogenous. Strong exogeneity requires, in addition to weak exogeneity, that Δy_{it} also fail to respond to the incorporated (ρ) lags of Δx_i. An alternative way to see this is to expand the VECM (equation 2) for the case of saving and investment, $x = [i \quad s]'$, as:

$$\begin{bmatrix} \Delta i_t \\ \Delta s_t \end{bmatrix} = \begin{bmatrix} \eta_1 \\ \eta_2 \end{bmatrix} + \begin{bmatrix} \sum_{i=1}^{l} \delta_{1i} & \sum_{i=1}^{m} \gamma_{1i} \\ \sum_{i=1}^{l} \delta_{2i} & \sum_{i=1}^{m} \gamma_{2i} \end{bmatrix} \begin{bmatrix} \Delta i_{t-i} \\ \Delta s_{t-i} \end{bmatrix} + \begin{bmatrix} \alpha_1 \\ \alpha_2 \end{bmatrix} [\beta_1 \quad \beta_2] \begin{bmatrix} i_{t-1} \\ s_{t-1} \end{bmatrix} + \begin{bmatrix} \varepsilon_1 \\ \varepsilon_2 \end{bmatrix} \qquad (3)$$

where α captures the speed of adjustment from a state of disequilibrium, defined by the last period's investment-saving gap [$gap = i_{t-1} - \beta_1 - \beta_2 s_{t-1}$], towards long-run equilibrium. If saving and investment are cointegrated, then deviations from the long-run equilibrium in the short-run will feed back on the changes in one or both variables in order to force

movement back towards long-run equilibrium[8]. Hence, one way to examine causality (or endogeneity of the dependent variable) is through the statistical significance of the αs. For example, if α_1 is statistically insignificant then the investment ratio is weakly exogenous since it does not respond to disequilibrium. Alternatively, if α_1 is significant then the change in the investment ratio is driven directly by this long-run equilibrium error and long-run causality is said to run from saving to investment. Additionally, if $\sum_{i=1}^{m} \gamma_{1i}$ is significant then changes in saving cause changes in investment (i.e. short-run causality runs from saving to investment). Non-significance of both measures indicates strong exogeneity of the investment ratio. The same analysis holds when saving is the dependent variable. It is perhaps worth stressing here that the term "long-run causality" should not be interpreted in a temporal sense since deviations from equilibrium are partially corrected between each short period. If, for example, there is unidirectional causality from saving to investment, then there are two possible scenarios. Investment could be responding in the short-term to deviations from the long-term equilibrium, implied by the cointegrating relationship, in order to restore the long-run equilibrium and we would say that long-run causality runs from saving to investment. However, investment could also be responding to short-term stochastic shocks in saving, in which case we would say that short-run causality runs from saving to investment.

Pesaran et al ARDL Framework

Pesaran and Shin (1999) and Pesaran et al. (2001) show that under certain conditions the autoregressive distributed lag models may be used for the estimation of long run relationships. They prove that once the order of the ARDL has been determined, OLS may be used for the purpose of estimation and identification. The presence of a unique long run relationship is crucial for valid estimation and inference. Such inferences on long- and short- run parameters may be made, provided that the ARDL model is correctly augmented to account for contemporaneous correlations between the stochastic terms of the data generating process included in the ARDL estimation. Hence, ARDL estimation is possible even where explanatory variables are endogenous.

[8] If the gap > 0, the adjustment back to equilibrium would require the saving ratio to rise and/or the investment ratio to fall. For gap < 0, the opposite responses would occur.

Moreover, ARDL remains valid irrespective of the order of integration of the explanatory variables.

The ARDL framework can be implemented by modelling the variables (for example, saving and investment) as a conditional ARDL- ECM:

$$\Delta i_t = c_0 + \omega_1 i_{t-1} + \omega_2 s_{t-1} + \sum_{i=1}^{p} \upsilon_i \Delta i_{t-i} + \sum_{j=1}^{q} \nu_i \Delta s_{t-i} + \varsigma_t \qquad (4)$$

where c_0 is the drift component, and ς_t are white noise errors. To test for the existence of a long-run relationship, an *F*-test is employed to assess for the joint significance of the coefficients of the lagged levels in equation 4 (so that $H_0 : \omega_1 = \omega_2 = 0$). Two asymptotic critical value bounds are provided in Pesaran et al. (2001) to test for *cointegration when the independent variables are I(d)* (where $0 \leq d \leq 1$): a lower value assuming the regressors are I(0), and an upper value assuming purely I(1) regressors. If the *F*-statistics exceed both critical values we can conclude that a long-run relationship exists. If it falls below the lower critical values, we cannot reject the null hypothesis of 'no *cointegration*'. If the statistics fall within their respective bounds, inference would be inconclusive.

Once cointegration is confirmed, the conditional long-run model for i_t can be recovered from the reduced form solution of equation 4:

$$i_t = \Theta_0 + \Theta_1 s_t + \tau_t \qquad (5)$$

where $\Theta_0 = c_o/\omega_1$, $\Theta_1 = -\omega_2/\omega_1$. These coefficients are obtained by first estimating equation 4 by OLS and then using the selection criteria to determine the optimal structure for the ARDL specification of the short-run dynamics. With both the long-run and short-run coefficients in hand, causality analysis can be done as before.

4.2 Estimation and Results

This study utilises annual data from the World Bank *World Development Indicators 2003 (WDI2003)* for the following Caribbean countries; Barbados, Guyana, Jamaica and Trinidad and Tobago spanning the period 1960 to 2001, the Organisation of Eastern Caribbean States[9] (OECS) over the period 1977 to 2001, and for the following Latin America countries; Argentina, Brazil, Chile, Colombia, Costa Rico, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Mexico, Paraguay, Peru, Uruguay, and Venezuela over 1960 to 2001.

The usual procedure in growth empirics and causality analyses is to work with rates. In this regard, there is often the question as to whether or not it makes sense to examine a ratio for a unit roots since a ratio cannot take a value greater than 1. In our view, it is possible to construct a process with time varying variance that does not necessary explode (for example, random walks with reflecting barriers are bounded but they are considered *I(1)* processes). In fact, for non-stationarity, all it takes is to violate at least one of these three conditions for stationarity *(i)* constant mean, *(ii)* finite variance independent of *t* and *(iii)* gamma (*s*) is independent of *t*, gamma *s* being the correlation function between processes *s* distance apart in time. If the ratios are of sufficient length it is expected that they will be *I(1)* (the previous studies have found this to be the general case - Table A-4 contains examples for the region with respect to investment and saving). Moreover, Taylor (1996) argues that the notion of shifts in savings and investment is an important feature of growth and structural shifts in the long run and, as an economy develops it is expected that these ratios will trend upwards.

Nevertheless, so as not to be caught up in the debate and since it would not take away from the analysis, we conduct our investigation on the totals of the variables; gross

[9] The OECS is a nine member grouping comprising Antigua and Barbuda, Commonwealth of Dominica, Grenada, St Kitts and Nevis, St Lucia, St Vincent and the Grenadines, Montserrat, Anguilla and the British Virgin Islands. The latter three are still British dependent territories, while Anguilla and the British Virgin Islands are only associate members of the OECS.

domestic saving[10], gross domestic investment (gross capital formation) and GDP. They are all deflated by the GDP deflator.

Stationarity Tests

We begin by examining the stationary properties of the ratios. First, we test for the order of integration using the Augmented Dickey-Fuller, ADF, (1979) and the Phillips-Perron, PP, (1988) tests for unit root. We also apply the KPSS test for stationarity (described in Kwiatkowski *et al.*, 1992). The reason using the three tests is that they complement each other and will allow us to place greater confidence in our results. More specifically, in the test equation the ADF corrects for higher order serial correlation by adding lagged differenced terms as regressors and, in small samples, the reduced degrees of freedom can affect the power of the test. The PP test makes a correction to the t-statistic of the coefficient of the lagged dependent variable to account for the serial correlation in the errors. At the same time, one potential problem with both the ADF and PP test is that they take a unit root as the null hypothesis. In this regard, Blough (1992) notes that unit root tests have a high probability of falsely rejecting the null of non-stationarity when the data generation process is close to a stationary process. This is because in finite samples it has been found that some unit root processes display behaviour closer to stationary white noise than to a non-stationary random walk, while some trend-stationary processes behave more like random walks (Harris, 1995). Hence, unit root tests with high power against any stationary alternative will have a high probability of a false rejection of the unit root when applied to near stationary processes. This is why we also utilise the KPSS test since it specifies the null hypothesis as stationarity.

The results from the stationary tests are presented in Table A-5. If the variables for a country are confirmed to be *I(1)* by the three tests (the ADF and PP fail to reject the null and the KPSS do) then we use the Johansen MLE for that country. If however there is

[10] In the WDI2003, gross domestic saving is define as GDP less final consumption expenditure and gross capital formation is measure as outlays on additions to the fixed assets of the economy plus net changes in the level of inventories. Fixed assets include land improvements, plant, machinery, and equipment purchases; and the construction of roads, railways, and the like (including schools, offices, hospitals, etc.). Inventories are stocks of goods held by firms to meet temporary or unexpected fluctuations in production or sales, and "work in progress."

ambiguity concerning the stationarity properties of one of the series (both either reject or fail to reject the null) then we move on to the ARDL framework since it is possible that the series is neither *I(0)* or *I(1)* but fractionally integrated, that is, *I(d), where 0<d<1.* The final possibility is that both series are *I(0)* (the ADF and PP reject the null and the KPSS fails to do so), in which case conventional regression analysis is suitable.

Except for a few cases, the three tests are in agreement that for each country the series are *I(1)*. For Guyana and Peru the ADF and PP tests suggest that the saving variable maybe *I(1)*, while the KPSS test points to stationarity. In the case of Jamaica, Argentina and Venezuela, the disagreement is with respect to both the saving and investment series. Therefore, in analysing the casual chains for these countries we utilise the ARDL procedure, while for the others we employ the Johansen MLE approach.

Causality Analysis of the Saving-Investment Relationship

The results of the Johansen MLE test for the number of cointegrating relationships are presented in Table A-6A. In each case the appropriate lag length is chosen using the Akaike information (AIC), Schwarz Bayesian (SB) and Hannan-Quinn (HQ) criteria. The procedure (as explained in Doornik *et al.* 1998) involves estimating an unrestricted VAR and testing for the appropriate lag length by ensuring the selected VAR behaves well and satisfactorily describes the data (passes all the necessary diagnostic tests including that of mis-specification and normality of the residuals). Once we have attained data congruency, we move the determination on the cointegration rank as outlined in Johansen (1988 and 1995) and Johansen Juselius (1990). For the ARDL approach, the results for the bounds tests for cointegration are contained in Table A-6B. To ensure that the results are not overly sensitive to the lag length we present the bounds tests for p and q equal to 1, 2 and 4 (although with annual data it is expected that the optimum length will be either 1 or 2). Note also that if a long-run relationship is confirmed between the two series then it is necessary to check for reverse causality. For example, if in the regression of saving on investment we find a level relationship, indicating that causality runs from investment to saving, we must also check for reverse causality through the regression of investment on saving. Only then in the absence of

reverse causality can we confirm that investment is the forcing variable and long-run causality runs from investment to saving.

The evidence suggests that, with the exception of El Salvador and Uruguay, all countries had a cointegrating relationship between saving and investment over the sample period. In the case of Uruguay, although we did find a data congruent VAR(2), our search for cointegration failed to uncover a stable relationship. For El Salvador we could not reject the null hypothesis of no cointegration over the full sample period, however, closer inspection indicated that the two series moved closely together between 1960 and 1980 but have since diverged with saving declining and investment rising. We therefore test for and found cointegration in the sub-period 1960-80 for El Salvador.

Table A-9 depicts the cointegration results for each country. The second column gives the long-run coefficient with investment as the dependent variable. Hence, β is the long-run elasticity of real gross domestic investment with respect to real gross domestic saving, however, an *r* beside the coefficient denotes that it refers to the opposite, that is, the long-run elasticity of real gross domestic saving with respect to real gross domestic investment. The third and fourth columns show the 'speed of adjustment to long-run' parameter; α_1 refers to the adjustment coefficient in the investment equation and if significant implies that investment respond to long-run disequilibrium[11]; hence investment is endogenous and is long-run 'caused' by saving, while α_2 holds the same meaning for the saving equation. Columns 5 and 6 give the Wald tests for short-run causality; 5 examines the impact of lagged changes in investment on current changes in saving, while 6 shows the effect of lagged changes in saving on current changes in investment. The diagnostics tests are given in columns 7-11.

[11] Disequilibrium in this case is defined as the $i - s = gap$. A positive (negative) gap exists if saving has fallen (risen) relative to investment in which case the significant α_1 implies that investment must fall (rise) to restore equilibrium and positive long run causality is said to run from saving to investment.

The results confirm the existence of a long-run relationship between real gross domestic investment and real gross domestic saving for all the countries (excluding Uruguay). For 17 of the 24 countries, this cointegrating relationship is defined with investment as the dependent variable (that is, saving is the long-run forcing variable) and for the others the reverse holds. We are not surprised at our findings, if one considers the implications of the alternative. Since the "flip-side" of the saving-investment relation is the current account balance, findings of no long-run (steady-state) relationship implies that the current account deficit does not converge to zero or a constant over time. Put differently, if saving and investment are not cointegrated then there is persistency in the current account deficit, even into the long-run. However, as Jansen *et al.* (1996) argue, one of the predictions of open-economy intertemporal general equilibrium models is that current account converges to a constant in steady-state. Therefore, although in the short-run shocks to the economy may cause saving and investment to diverge from their steady-state relation, they must eventually return to it.

In terms of the dynamics governing these cointegrating relationships, for 14 of the 23 countries (Barbados, Chile, Dominica, Dominican Republic, Grenada, St. Lucia, Guatemala, Guyana, Honduras, Jamaica, Mexico, Peru, Trinidad and Tobago and Venezuela), the nature of the long-run relationship is such that when the system is in disequilibrium, investment adjusts to close the gap and saving can be treated as a 'long-run' forcing variable in the explanation of investment. That is, long-run causality runs from saving to investment in these countries (investment is endogenous and saving is weakly exogenous). For 6 countries, Antigua and Barbuda, St. Kitts and Nevis, Argentina, Costa Rica, Ecuador and El Salvador, the direction of causality is reversed, while for Brazil, Colombia and Paraguay bi-directional causality exists.

The results suggest a general absence of short-run causality between saving and investment in LAC. We only find 1 case (Ecuador) where lagged changes in investment impact on current changes in saving and also 1 case of the reverse (Dominican Republic). This is not to say that there is no short-run relationship between these variables since the above analysis suggests that changes in saving (investment)

induced by disequilibria can cause changes in investment (saving). In fact, any shock to either saving or investment (or to the economy as a whole), to the extent that it causes them to move away from their steady-state will induce changes in either one or both variables to restore equilibrium. It may be argued that to some degree this result, of a general absence of short-run causality, is influenced by our modelling procedure. In many cases, our model specification search resulted in a VAR(1), which transforms to a VECM(0) and thus excludes the possibility of short-run dynamics. However, in each case we also re-estimated the VECM using a general-to specific approach with respect to the lags and in no case did any lag higher than that chosen in the specification search survive the deletion process. Therefore, we are confident that these results are fairly robust.

Causality Analysis of the Saving-GDP Relationship

The Johansen test for the number of cointegration vectors (if any) in the bi-variant relationship between real gross domestic saving and real GDP for each country are given in Table A-7A, the bounds tests results for cointegration are presented in Table A-7B. The results indicate that there exist, at most, one cointegrating vector for Antigua and Barbuda, Colombia, Costa Rica, Dominica, Dominican Republic, Grenada, Guatemala, Jamaica, St. Kitts and Nevis, Trinidad and Tobago and Uruguay. However, we could not reject the null hypothesis of no cointegration for the other countries in the sample.

The cointegration results and causality analysis between real gross domestic saving and real GDP are presented in Table A-10. Considering those countries for which we found a long-run relationship, the estimated *as* indicate that in Costa Rica, Dominican Republic, Grenada, St. Kitts and Nevis and Uruguay, it is gross domestic saving that responds to long-run disequilibrium. Hence, long-run causality runs from growth to saving in these countries. This result is quite consistent with the earlier studies including Gavin et al. (1997). For Antigua and Barbuda, there is evidence of bi-directional temporal dependence between the two series, while for Colombia, Dominica,

Guatemala, Jamaica and Trinidad and Tobago there is unidirectional long-run causality from saving to growth.

In terms of short-run causality, we find that lagged changes in saving caused growth in Chile and Guatemala, with a positive and negative signs, respectively, while the reverse holds for Brazil, Guyana and El Salvador, with a positive sign. We were unable to detect any significant short-run causal chains for the other countries at the standard 5 per cent level of significance. These results along with the above cointegration analysis imply that for Barbados, St. Lucia, Argentina, Ecuador, Honduras, Mexico, Peru and Venezuela there is no causal relationship between saving and growth (at least at the 5% significance level since there is some evidence of lagged changes in saving causing current changes in GDP in Barbados at the 10% significance level).

Causality Analysis on the Investment-GDP relationship

Table A-8A contain the results of Johansen tests for cointegration between real gross domestic investment and GDP, while Table A-8B presents the results of the bounds tests. We find a long-run relationship for the following 15 countries; Antigua and Barbuda, Brazil, Colombia, Costa Rica, Dominica, Dominican Republic, Ecuador, El Salvador, Grenada, Honduras, Mexico, Peru, St. Lucia, St. Vincent and the Grenadines and Trinidad and Tobago. In examining the dynamics governing these steady-state relationships, the α coefficients (given in Table A-11) suggest that for the Dominican Republic, Ecuador and El Salvador both variables respond to maintain equilibrium and hence bi-directional long-run causality exists for these countries. For Trinidad and Tobago the results point to unidirectional long-run causality from growth to investment, while for the other 11 countries the evidence favours long-run causality that is unidirectional from investment to growth.

Table A-11 also contains the results for the short-run causality analysis. We found 6 cases (Brazil, Chile, Ecuador, Guatemala, Honduras and Mexico) where lagged changes in GDP impact positively on current changes in investment. This result is consistent with the findings of Blomstrom *et al.* (1996), who argue that higher growth

can create incentives to new investment by enhancing future growth expectations. There is only one case (St. Vincent and the Grenadines) of short-run causality running from investment to growth.

5. Interpreting the Causality Evidence in terms of Financial Development

Table 2 summarises the causality results in terms of financial development as given in Table 1. The first conclusion we can gather, by considering the columns depicting the *s-y* and *i-y* relationships, is that there is evidence to support the different views on the nexus between finance and growth. There are 7 cases (Chile, Colombia, Antigua and Barbuda, St. Vincent and the Grenadines, Brazil, Dominican Republic and Ecuador) in support of both the supply-leading and demand-following hypotheses; 4 cases (Barbados, Trinidad and Tobago, Dominica and Jamaica) of the supply-leading hypothesis; 8 for the demand-following theory (Guyana, Grenada, St. Kitts and Nevis, St. Lucia, Honduras, Uruguay, Mexico, Peru and Costa Rica); and, 3 cases (Paraguay, Argentina and Venezuela) where there seems to be no significant relationship between the two sectors. The finding of varying causal relationships is quite consistent with previous studies, as discussed in section 2, which find that the impact of finance differs by countries.

It also appears as if the causal chains between saving, investment and growth are not fashioned by the level of financial development; even within each group the results are mixed. Since this categorisation of financial development is based on the indicators of banking sector development, we reclassify the results using the two stock market indicators, *TOR* and *CY*[12]. However, we are unable to discern any significant patterns with the new classification. Another possibility, though highly unlike given degree of variability within the groups, is that the results are influenced by our choice of boundaries to sort the countries into respective levels of financial development. In that

[12] The results are available from the authors upon request.

regard, we also reclassify the countries' level of financial development[13]. Again, our results are robust to the reclassification.

Table 12 Summary of Results of Causal Chains

	Long-run (responding to disequilibrium)			Short-run (responding to stochastic shocks)		
Financial Develop.	$s \cdots ? \cdots i$	$s \cdots ? \cdots y$	$i \cdots ? \cdots y$	$s \cdots ? \cdots i$	$s \cdots ? \cdots y$	$i \cdots ? \cdots y$
High						
Chile	$\xrightarrow{+}$	none	none	na	$\xrightarrow{+}$	$\xleftarrow{+}$
Colombia	$\underset{+}{\overset{+}{\rightleftarrows}}$	$\xrightarrow{+}$	$\xleftarrow{+}$	na	na	none
Paraguay	$\xrightarrow{+}$	none	none	na	na	none
Medium-High						
Barbados	$\xrightarrow{+}$	none	none	none	$\xrightarrow{-}$	na
Guyana	$\xrightarrow{+}$	none	none	none	$\xleftarrow{+}$	none
Trinidad and Tobago	$\xrightarrow{+}$	$\xrightarrow{+}$	$\xrightarrow{+}$	na	na	na
Antigua & Barbuda	$\xleftarrow{+}$	$\underset{+}{\overset{+}{\rightleftarrows}}$	$\xleftarrow{+}$	na	na	none
Dominica	$\xrightarrow{+}$	$\xrightarrow{+}$	$\xrightarrow{+}$	none	na	na
Grenada	$\xrightarrow{+}$	$\xleftarrow{+}$	$\xleftarrow{+}$	none	na	none
St. Kitts and Nevis	$\xleftarrow{+}$	$\xleftarrow{+}$	none	na	none	none
St. Lucia	$\xrightarrow{+}$	none	$\xleftarrow{+}$	none	none	$\xleftarrow{-}$
St. Vincent & the Grenadines	none	none	$\underset{+}{\overset{+}{\rightleftarrows}}$	na	na	$\underset{-}{\overset{+}{\rightleftarrows}}$
Brazil	$\underset{+}{\overset{+}{\rightleftarrows}}$	none	$\xleftarrow{+}$	na	$\xleftarrow{+}$	$\xleftarrow{+}$
Dominican Republic	$\xrightarrow{+}$	$\xleftarrow{+}$	$\underset{+}{\overset{+}{\rightleftarrows}}$	$\xrightarrow{-}$	na	na
Ecuador	$\xleftarrow{+}$	none	$\underset{+}{\overset{+}{\rightleftarrows}}$	$\xleftarrow{-}$	na	$\xleftarrow{+}$
Guatemala	$\xrightarrow{+}$	$\xrightarrow{+}$	none	na	$\xleftarrow{+}$	$\xleftarrow{+}$
Honduras	$\xrightarrow{+}$	none	$\xleftarrow{+}$	none	na	$\xleftarrow{+}$
Uruguay	none	$\xleftarrow{+}$	none	none	na	none

[13] A country is classified as having a low-medium level of financial development if its *index* value falls between -1 standard deviation (*SD*) and the sample mean, a medium-high level if the value lies between the sample mean and +1 *SD*, a high level if it is above +1 *SD*, and a low level if it is below +1 *SD*. The results are available from the authors upon request.

Table 12 continued

	Long-run (responding to disequilibrium)			Short-run (responding to stochastic shocks)		
Financial Develop.	$s \cdots ? \cdots i$	$s \cdots ? \cdots y$	$i \cdots ? \cdots y$	$s \cdots ? \cdots i$	$s \cdots ? \cdots y$	$i \cdots ? \cdots y$
Low-Medium						
Jamaica	$\xrightarrow{+}$	$\xrightarrow{+}$	none	none	na	na
Argentina	$\xleftarrow{+}$	none	none	na	na	na
Mexico	$\xrightarrow{+}$	none	$\xleftarrow{+}$	none	none	$\xleftarrow{+}$
Peru	$\xrightarrow{+}$	none	$\xleftarrow{+}$	none	na	none
Low						
El Salvador	$\underset{+}{\overset{+}{\rightleftarrows}}$ *	none	$\underset{+}{\overset{-}{\rightleftarrows}}$	none	$\xleftarrow{+}$	na
Costa Rica	$\xleftarrow{+}$	$\xleftarrow{+}$	$\xleftarrow{+}$	na	na	na
Venezuela	$\xrightarrow{+}$	none	none	none	na	na

Notes: na indicates that short-run dynamics are rule out because the model specification search favoured a VAR(1), which results in a VECM of order zero. *none* denotes that no statistical significant (at the 5% level) relationship was found. * indicates that the relationship only held over the period 1960-1980.

Given our conclusion, that the level of financial development is not central to the relationship between saving, investment and economic growth, the natural question to ask is what may be influencing this relationship. In this regard, a number of possible hypotheses come to mind, although a full exploration of these is beyond the scope of this paper. Perhaps the most oblivious is differences in the economic conditions of the countries. This area has received very little attention in the empirical literature and we are in fact only aware of one such study, which is that of Rousseau and Wachtel (2002). They show that the link between the financial sector and growth is influenced by the inflation rate. Moreover, there appears to be an inflation threshold after which the positive effects of finance cease. Apart from differences in inflation, one can also imagine that differences in the productive structures can influence this relationship. The financial system in an economy that is predominantly agricultural based will not have the same structure or requirements placed on it as one where the economy is mainly driven by financial services. Institutional, legal and cultural factors can also influence the relationship between the financial sector and growth as discussed in Demirguc-Kunt and Maksimovic (1998). For example, a fully funded social security system will have a

greater impact on stock market development then a pay-as-you-go system and by extension promotes a more efficient allocation of resources. Therefore, the nexus between the financial sector and growth will be stronger under the former. Garvin (1997) argues that the change to a fully funded security system was one of the main drivers behind the capital market in Chile and lead to a 3 percent rise in saving.

6. Conclusion Remarks and Policy Implications

Our study attempts to examine the causal chains between saving, investment and growth for LAC within the context of financial development. In this regard, it can be seen as dealing with two separate (in terms of how they are usually dealt with in the literature) but intimately related issues: the finance-growth nexus, which is the causal relationship between financial development and growth, and the saving-investment-growth nexus, which looks at the causal links between these three aggregates. Yet, the two are married in the sense that the channels through which financial development affects growth are saving and investment. Hence, one can ask the question whether the level of financial development of a country influences the causal relationships between saving, investment and growth. In addressing these issues we use traditional measures of financial development to classify the countries accordingly. We employ different classification rules to test the robustness of our results. Next we investigate the causal chains between saving, investment and growth using cointegration analysis and after that evaluate the results within the context of our earlier classifications.

The results between saving and investment suggest that for Barbados, Chile, Dominica, Grenada, St. Lucia, Guatemala, Guyana, Honduras, Jamaica, Mexico, Peru, Trinidad and Tobago and Venezuela causality runs from saving to investment, while for Antigua and Barbuda, St. Kitts and Nevis, Argentina, Costa Rica, and El Salvador, the direction is reversed, and for Brazil, Ecuador, Colombia, Dominican Republic and Paraguay bi-directional causality exists. Hence, for the first and third group of countries, policies to increase saving will eventually lead to higher investment as the latter adjusts to the new equilibrium caused by the increased saving. In the second group, such polices will be unsuccessful.

The results on saving and growth indicate that causality runs from the latter to the former in Brazil, Costa Rica, Dominican Republic, El Salvador, Grenada, Guyana, St. Kitts and Nevis and Uruguay. Hence, for these countries policy efforts should be concentrated more on the real economy and removing any impediments to growth than on raising the saving rate. For Chile, Colombia, Dominica, Guatemala, Jamaica and Trinidad and Tobago causality is from saving to growth and therefore the tradition recipe for stimulating growth via saving holds.

For the investment-growth relationship, we find that for Antigua and Barbuda, Colombia, Costa Rica, Dominica, Grenada, Honduras, Mexico, Peru, St. Lucia and St. Vincent and the Grenadines higher investment leads to faster growth. For, Brazil, Dominican Republic, Ecuador, El Salvador, Honduras and Mexico the causal chain is bi-directional, while for Chile, Ecuador, Guatemala, Trinidad and Tobago it runs growth to investment.

These results also lend support to the different views of the finance-growth hypothesis in that we are able to find cases where financial development leads growth, cases where it is a results of growth and even cases where it no detectable causal relationship between the two sectors. Furthermore, our findings suggest that the saving-investment-growth nexus is independent of the level of financial development. Therefore, further research is needed to ascertain what factors influence this relationship. For example, how differences in policy regimes such as exchange rate regimes and fiscal and monetary practices affect or even fashion these relationships. Also, the underlying economic structures, what role are they playing in helping to fashion these relationships?

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Appendix

Figure A-1

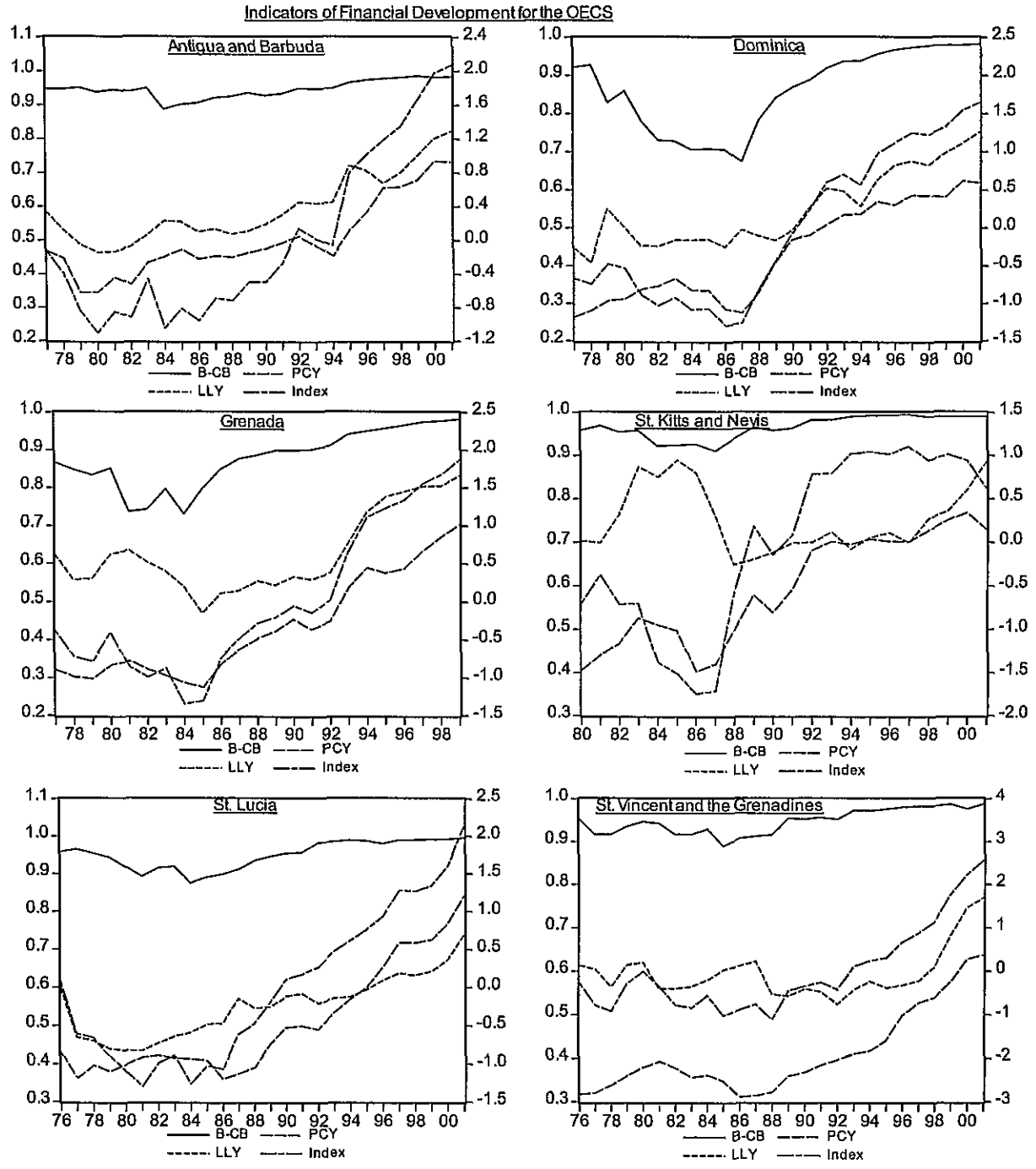

Figure A-2

Indicators of Financial Development for the Latin America Countries

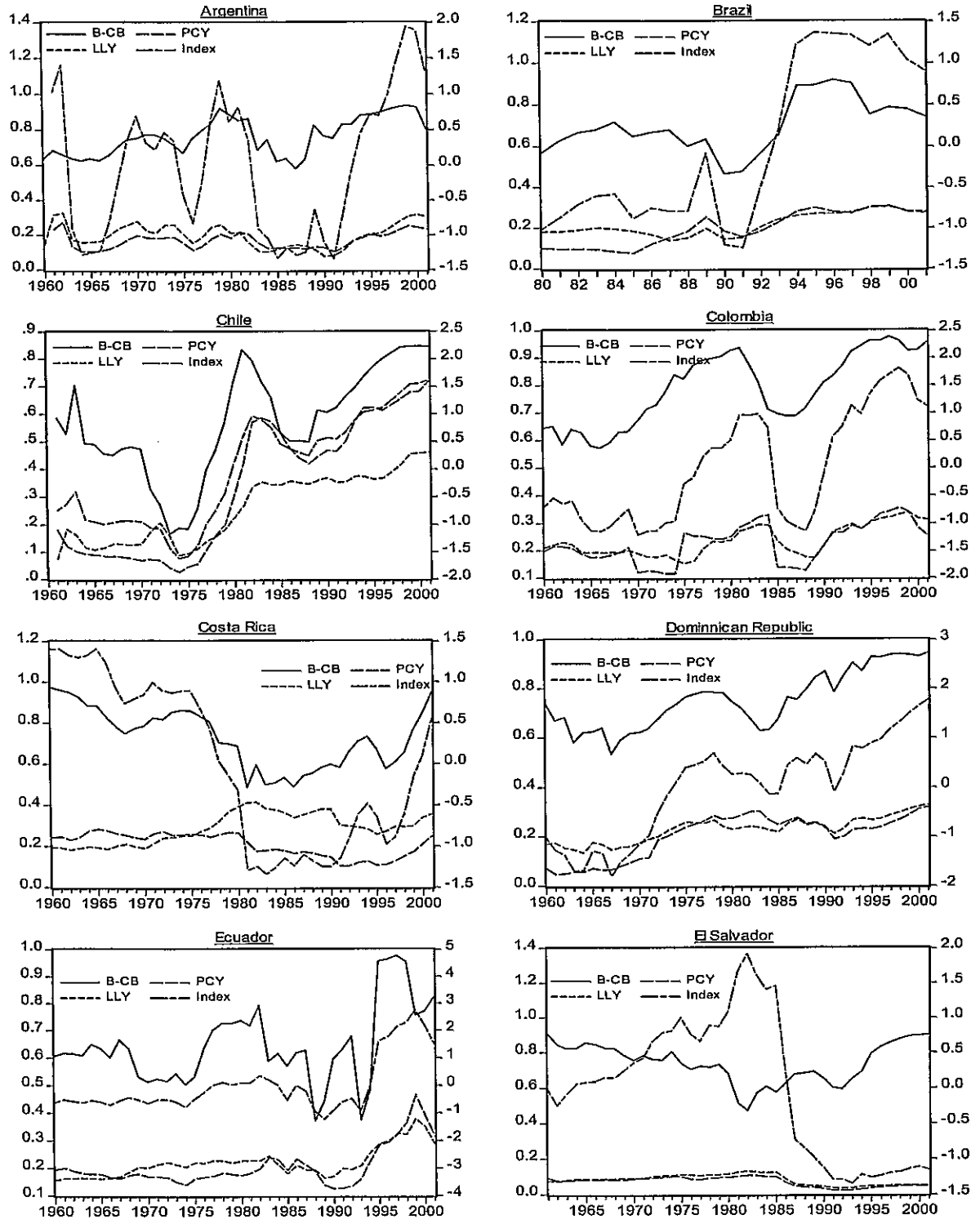

Figure A-2 Continued

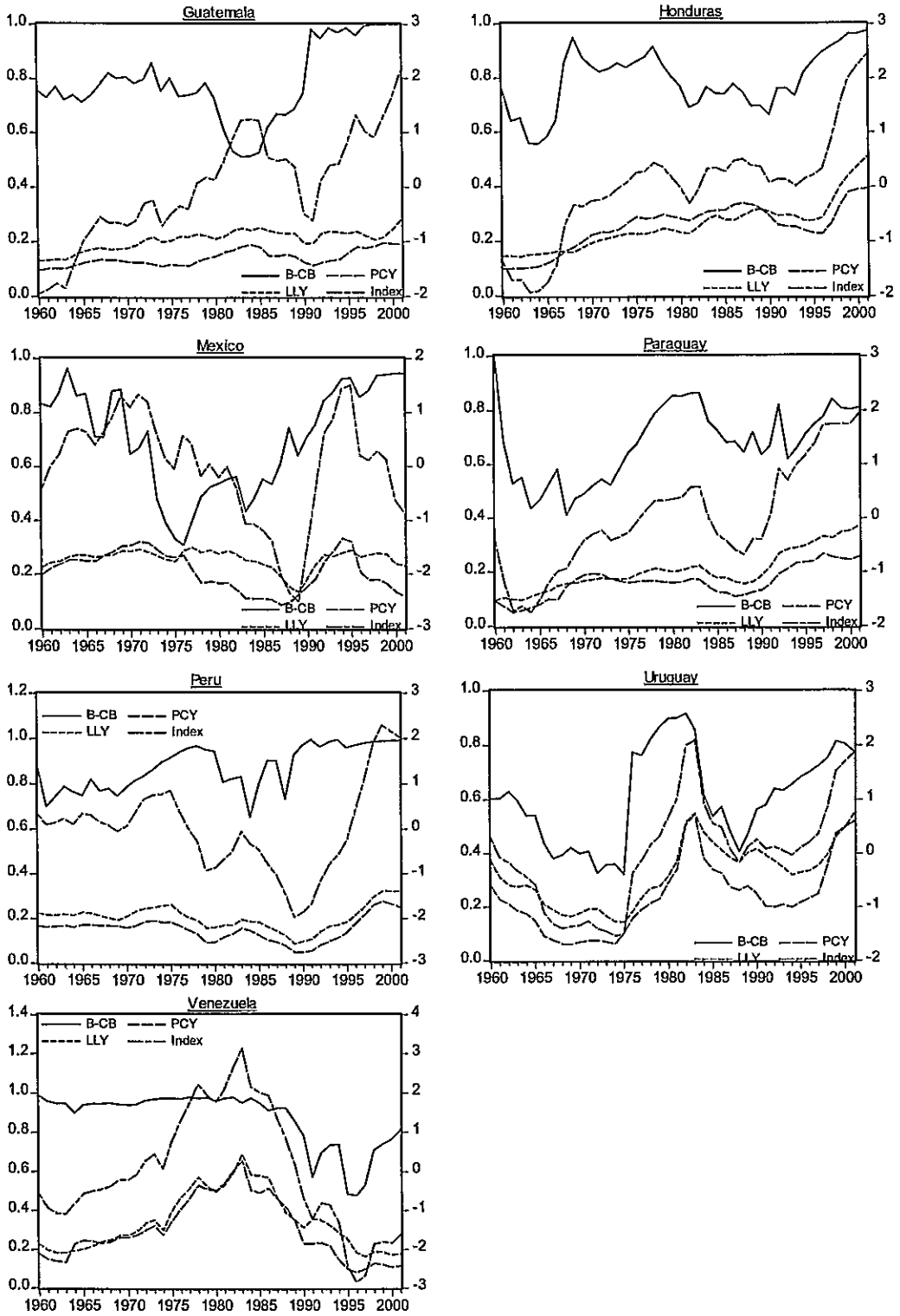

Figure A-3

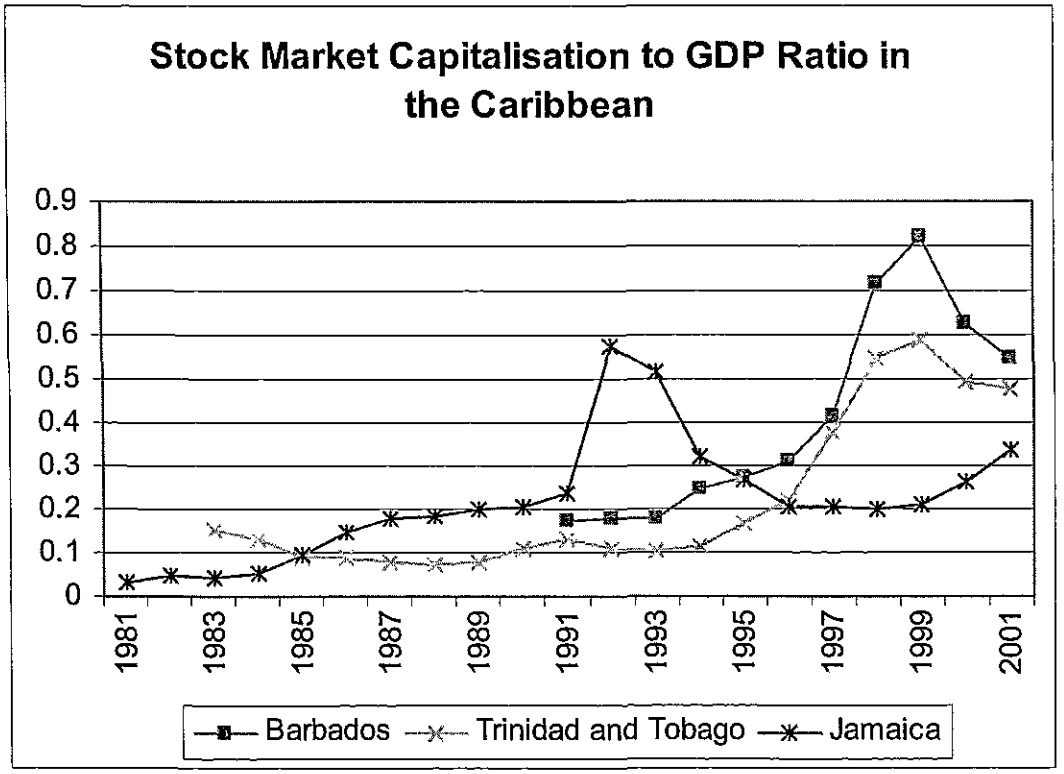

Figure A-4

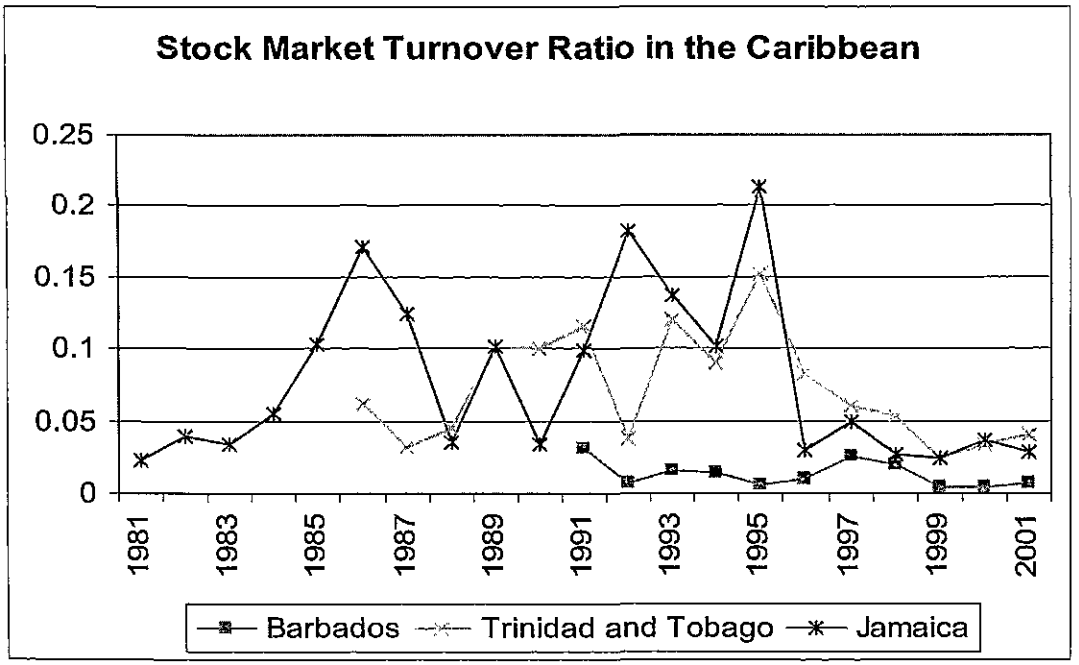

Figure A-5

Figure A-6

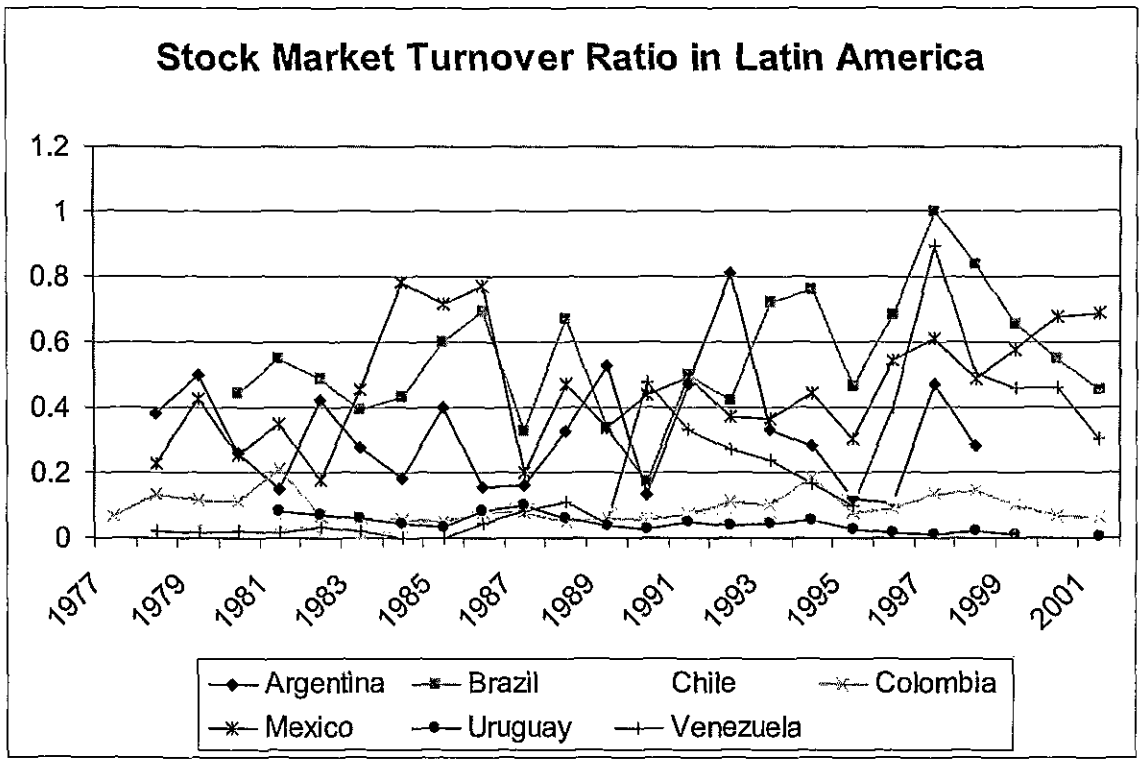

Table A-1 Indicators of Financial Development - Some Descriptive Statistics

Country	Period	B-CB				LLY				PCY			
		Mean	S.D.	Max.	Min.	Mean	S.D.	Max.	Min.	Mean	S.D.	Max.	Min.
Barbados	1967-01	0.924	0.047	1.000	0.836	0.547	0.106	0.777	0.386	0.427	0.069	0.577	0.310
Guyana	1967-01	0.496	0.247	0.953	0.171	0.687	0.288	1.302	0.304	0.228	0.119	0.480	0.095
Jamaica	1960-01	0.770	0.166	0.984	0.479	0.366	0.087	0.494	0.196	0.240	0.054	0.340	0.136
Trinidad and Tobago	1960-01	0.919	0.073	0.994	0.734	0.398	0.145	0.609	0.213	0.3048	0.1548	0.535	0.0792
OECS													
Antigua & Barbuda	1977-01	0.947	0.026	0.986	0.889	0.596	0.103	0.823	0.465	0.502	0.111	0.735	0.345
Dominica	1977-01	0.864	0.106	0.982	0.676	0.549	0.101	0.753	0.408	0.434	0.127	0.624	0.263
Grenada	1977-99	0.878	0.077	0.982	0.732	0.628	0.107	0.833	0.471	0.433	0.135	0.703	0.276
St. Kitts & Nevis	1977-01	0.966	0.027	0.996	0.911	0.753	0.077	0.891	0.648	0.593	0.125	0.767	0.404
St. Lucia	1976-01	0.951	0.038	0.997	0.875	0.551	0.081	0.740	0.435	0.509	0.144	0.843	0.360
ST. Vincent & Grena.	1976-01	0.948	0.029	0.988	0.890	0.596	0.059	0.769	0.525	0.412	0.096	0.637	0.312
LATIN AMERICA													
Argentina	1960-01	0.768	0.104	0.938	0.583	0.201	0.069	0.204	0.076	0.169	0.046	0.275	0.105
Brazil	1980-01	0.698	0.129	0.921	0.469	0.218	0.055	0.305	0.139	0.197	0.084	0.309	0.077
Chile	1960-01	0.573	0.196	0.848	0.168	0.260	0.124	0.461	0.077	0.337	0.027	0.721	0.243
Colombia	1960-01	0.790	0.132	0.978	0.574	0.236	0.055	0.339	0.154	0.228	0.072	0.357	0.116
Costa Rica	1960-01	0.729	0.145	0.973	0.488	0.287	0.074	0.415	0.182	0.208	0.057	0.283	0.105
Dominican Republic	1960-01	0.754	0.118	0.945	0.536	0.229	0.051	0.329	0.133	0.204	0.088	0.320	0.048
Ecuador	1960-01	0.647	0.145	0.978	0.371	0.220	0.054	0.378	0.156	0.207	0.074	0.467	0.125
El Salvador	1961-01	0.742	0.112	0.907	0.473	0.081	0.030	0.132	0.035	0.072	0.027	0.108	0.024
Guatemala	1960-01	0.786	0.144	0.999	0.511	0.207	0.036	0.281	0.131	0.141	0.029	0.196	0.096
Honduras	1960-01	0.791	0.111	0.974	0.556	0.256	0.087	0.510	0.143	0.252	0.082	0.394	0.098
Mexico	1960-01	0.704	0.194	0.963	0.309	0.256	0.036	0.300	0.134	0.211	0.073	0.332	0.087
Paraguay	1960-01	0.680	0.140	0.999	0.412	0.203	0.075	0.372	0.095	0.161	0.058	0.268	0.052
Peru	1960-01	0.876	0.098	0.995	0.654	0.204	0.056	0.323	0.086	0.151	0.055	0.278	0.048
Uruguay	1960-01	0.608	0.176	0.917	0.322	0.322	0.115	0.550	0.143	0.237	0.135	0.546	0.061
Venezuela	1960-01	0.871	0.144	0.988	0.478	0.342	0.149	0.687	0.164	0.300	0.159	0.655	0.081

Table A-2 Principal Component Analysis

Country	Eigenvalues			Variance Proportion			Eigenvector1		
	1st	2nd	3rd	1st	2nd	3rd	B-CB	LLY	PCY
Barbados	2.427	0.431	0.142	0.809	0.144	0.047	-0.536	-0.588	-0.605
Guyana	2.177	0.581	0.242	0.726	0.194	0.081	-0.625	0.561	-0.542
Jamaica	2.311	0.570	0.118	0.770	0.190	0.039	-0.519	0.632	0.576
Trinidad and Tobago	2.228	0.751	0.022	0.743	0.250	0.007	-0.411	0.642	0.647
OECS									
Antigua & Barbuda	2.563	0.382	0.056	0.854	0.127	0.019	-0.533	-0.602	-0.595
Dominica	2.614	0.292	0.094	0.871	0.097	0.031	-0.553	-0.585	-0.593
Grenada	2.619	0.326	0.056	0.873	0.109	0.019	-0.562	-0.562	-0.607
St. Kitts & Nevis	1.926	0.953	0.121	0.642	0.318	0.040	-0.696	0.281	-0.660
St. Lucia	2.569	0.300	0.131	0.856	0.100	0.044	-0.556	-0.584	-0.591
ST. Vincent & Grena.	2.184	0.710	0.106	0.728	0.237	0.035	-0.567	-0.499	-0.655
LATIN AMERICA									
Argentina	2.197	0.688	0.115	0.732	0.229	0.038	-0.484	-0.588	-0.648
Brazil	2.457	0.391	0.151	0.819	0.130	0.050	-0.560	-0.607	-0.564
Chile	2.687	0.286	0.027	0.896	0.095	0.009	-0.548	-0.582	-0.600
Colombia	2.430	0.397	0.173	0.810	0.132	0.058	-0.545	-0.589	-0.597
Costa Rica	2.210	0.591	0.199	0.737	0.197	0.066	-0.630	0.565	-0.533
Dominican Republic	2.600	0.361	0.039	0.867	0.120	0.013	-0.555	-0.612	-0.563
Ecuador	2.416	0.452	0.132	0.805	0.151	0.044	-0.528	-0.601	-0.599
El Salvador	2.057	0.930	0.013	0.686	0.310	0.004	-0.289	0.692	0.661
Guatemala	1.728	0.990	0.282	0.576	0.330	0.094	-0.116	-0.702	-0.703
Honduras	2.262	0.582	0.156	0.754	0.194	0.052	-0.499	-0.612	-0.614
Mexico	1.618	1.002	0.379	0.539	0.334	0.126	-0.212	-0.674	-0.708
Paraguay	2.221	0.711	0.068	0.740	0.237	0.023	-0.444	-0.646	-0.620
Peru	1.983	0.997	0.020	0.661	0.332	0.007	-0.071	-0.706	-0.704
Uruguay	2.502	0.452	0.046	0.834	0.151	0.015	-0.523	-0.589	-0.616
Venezuela	2.326	0.650	0.024	0.775	0.217	0.008	-0.468	-0.607	-0.642

Notes: Eigenvalue reports the eigenvalues of the sample second moment matrix in order of size. Variance Proportion is the proportion variance explained by each principal component. The Eigenvector1 column displays the eigenvector corresponding to the first eigenvalue. The first principal component (Index) is computed as a linear combination of the indicators with weights given by the eigenvector1.

Table A-3 Correlation between the Indicators of Financial Development

Country	B_CBB-CB			LLY			PCY			Combined Index		
	LLY	PCY	C.Index	B-CB	PCY	C.Index	B-CB	LLY	C.Index	B-CB	LLY	PCY
Barbados	0.605	0.676	0.835	0.605	0.851	0.917	0.676	0.851	0.943	0.835	0.917	0.943
Guyana	-0.692	-0.421	0.828	-0.692	0.642	-0.923	-0.421	0.642	-0.800	0.828	-0.923	-0.800
Jamaica	-0.674	-0.444	0.790	-0.674	0.830	-0.960	-0.444	0.830	-0.875	0.790	-0.960	-0.875
Trinidad and Tobago	-0.379	-0.404	0.614	-0.379	0.978	-0.959	-0.404	0.978	-0.965	0.614	-0.959	-0.965
OECS												
Antigua & Barbuda	0.713	0.678	0.853	0.713	0.943	0.964	0.678	0.943	0.952	0.853	0.964	0.952
Dominica	0.740	0.774	0.894	0.740	0.904	0.947	0.774	0.904	0.959	0.894	0.947	0.959
Grenda	0.674	0.874	0.909	0.674	0.875	0.910	0.874	0.875	0.982	0.909	0.910	0.982
St. Kitts & Nevis	-0.303	0.848	0.967	-0.303	-0.075	-0.390	0.848	-0.075	0.916	0.967	-0.390	0.916
St. Lucia	0.728	0.756	0.891	0.728	0.868	0.937	0.756	0.868	0.947	0.891	0.937	0.947
ST. Vincent & Grena.	0.298	0.799	0.838	0.298	0.645	0.738	0.799	0.645	0.968	0.838	0.738	0.968
LATIN AMERICA												
Argentina	0.337	0.588	0.717	0.337	0.835	0.872	0.588	0.835	0.961	0.717	0.872	0.961
Brazil	0.780	0.609	0.878	0.780	0.793	0.951	0.609	0.793	0.884	0.878	0.951	0.884
Chile	0.739	0.825	0.899	0.739	0.962	0.955	0.825	0.962	0.984	0.899	0.955	0.984
Colombia	0.642	0.673	0.850	0.642	0.825	0.918	0.673	0.825	0.930	0.850	0.918	0.930
Costa Rica	-0.735	0.652	0.937	-0.735	-0.414	-0.840	0.652	-0.414	0.792	0.937	-0.840	0.792
Dominican Republic	0.860	0.640	0.894	0.860	0.893	0.987	0.640	0.893	0.909	0.894	0.987	0.909
Ecuador	0.627	0.619	0.821	0.627	0.868	0.934	0.619	0.868	0.932	0.821	0.934	0.932
El Salvador	-0.333	-0.114	0.415	-0.333	0.962	-0.993	-0.114	0.962	-0.948	0.415	-0.993	-0.948
Guatemala	0.055	0.065	0.152	0.055	0.718	0.923	0.065	0.718	0.924	0.152	0.923	0.924
Honduras	0.510	0.517	0.750	0.510	0.844	0.921	0.517	0.844	0.923	0.750	0.921	0.923
Mexico	-0.004	0.189	0.269	-0.004	0.590	0.857	0.189	0.590	0.900	0.269	0.857	0.900
Paraguay	0.489	0.365	0.662	0.489	0.921	0.963	0.365	0.921	0.925	0.662	0.963	0.925
Peru	0.078	0.021	0.100	0.078	0.978	0.995	0.021	0.978	0.992	0.100	0.995	0.992
Uruguay	0.587	0.713	0.827	0.587	0.939	0.932	0.713	0.939	0.975	0.827	0.932	0.975
Venezuela	0.410	0.579	0.714	0.410	0.956	0.926	0.579	0.956	0.979	0.714	0.926	0.979

Table A-4

	Cointegration		Stationarity S/Y		Stationarity I/Y	
	YES	NO	I(0)	I(1)	I(0)	I(1)
Argentina	Taylor(1998), Schneider(1999)	Sinha(2004), Kristen(2000)		Kristen(2000), Taylor(1998), Schneider(1999)		Kristen(2000), Taylor(1998), Schneider(1999)
Chile	Schneider(1999)	Sinha(2004), Kristen(2000)		Kristen(2000), Schneider(1999)		Kristen(2000), Schneider(1999)
Colombia	Kristen(2000)	Sinha(2004), Sinha(1998)		Sinha(1998), Schneider(1999)	Schneider(1999)	Sinha(1998),
Costa Rica	Sinha(2004)	Kristen(2000)		Kristen(2000), Schneider(1999)	Kristen(2000), Schneider(1999)	
Dominican Republic		Sinha(2004), Sinha(1998)	Sinha(1998), Schneider(1999)		Schneider(1999)	Sinha(1998)
Ecuador	Sinha(1998), Sinha(2004), Schneider(1999)	Kristen(2000)	Kristen(2000)	Sinha(1998), Schneider(1999)		Sinha(1998), Kristen(2000), Schneider(1999)
EL Salvador	Sinha(2004), Schneider(1999)	Kristen(2000), Sinha(1998)		Kristen(2000), Sinha(1998), Schneider(1999)		Kristen(2000), Sinha(1998), Schneider(1999)
Guatemala	Kristen(2000), Schneider(1999)	Sinha(2004), Sinha(1998)		Sinha(1998), Kristen(2000), Schneider(1999)		Sinha(1998), Kristen(2000), Schneider(1999)
Guyana	Sinha(2004)					
Honduras	Sinha(1998), Kristen(2000), Schneider(1999)	Sinha(2004)		Sinha(1998), Kristen(2000), Schneider(1999)		Sinha(1998), Kristen(2000), Schneider(1999)
Jamaica	Sinha(1998)	Sinha(2004)		Sinha(1998), Schneider(1999)	Schneider(1999)	Sinha(1998)
Mexico	Kristen(2000),	Sinha(2004), Sinha(1998), Schneider(1999)		Sinha(1998), Kristen(2000), Schneider(1999)		Sinha(1998), Kristen(2000), Schneider(1999)
Panama	Sinha(1998)	Sinha(2004)		Sinha(1998)		Sinha(1998)
Paraguay		Sinha(2004), Kristen(2000)	Kristen(2000), Schneider(1999)			Kristen(2000), Schneider(1999)
Peru	Kristen(2000), Schneider(1999)	Sinha(2004)		Kristen(2000), Schneider(1999)		Kristen(2000), Schneider(1999)
Trinidad &Tobago	Sinha(2004)					
Uruguay	Sinha(2004)		Kristen(2000)		Kristen(2000)	
Venezuela	Kristen(2000), Schneider(1999)	Sinha(2004), Sinha(1998)		Sinha(1998), Kristen(2000), Schneider(1999)		Sinha(1998), Kristen(2000), Schneider(1999)

The sample period for Kristen et al. (2000) is 1972-1996 and they use the Engle- Granger 2-step approach to cointegration. Taylor (1998) sample period is divided into 4 sub-periods; 1880-1913, 1914-1945, 1946-1971, 1972-1992, and he utilise OLS on equation 3.5. Sinha et al. (2004) sample period is not stated but they also use OLS on equation 3.5. For Sinha et al. (1998), the periods are Colombia (1957-94), Dominican Republic Ecuador, Venezuela and Honduras (1950-95), Guatemala, Mexico, and Panama (1950-94), Jamaica (1951-93), El Salvador (1951-94), Johansen MLE. The sample period for Schneider (1999) is not stated, he use Johansen MLE.

Table A-5 Results of Tests for Stationarity

	s		i		y	
Caribbean	Level	Δ	Level	Δ	Level	Δ
Barbados	-2.321 [-2.321] {0.689^{++}}	-7.848*** [-8.814***] {0.301}	-2.235 [-2.236] {0.549^{++}}	-6.354*** [-6.711***] {0.099	-0.565 [-0.781] {0.802^{+++}}	-5.406*** [-5.417***] {0.038}
Guyana	-2.783** [-2.647* {0.397^{+}}	-10.002*** [-10.343***] {0.131}	-2.033 [-2.128] {0.294}	-5.703*** [-6.462***] {0.101}	-1.348 [-1.319] {0.390^{+}}	-4.343*** [-4.356***] {0.136}
Jamaica	-2.427 [-2.423] {0.146}	-7.048*** [7.173***] {0.084}	-1.629 [-1.670] {0.306}	-6.284*** [-6.284***] {0.072}	-2.320 [-2.149] {0.625^{++}}	-4.684*** [-4.794***] {0.190}
Trinidad	-1.209 [-1.041] {0.660^{++}}	-6.243*** [-7.011***] {0.087}	-1.179 [-1.165] {0.587^{++}}	-6.945*** -6.924***] {0.0843}	-0.926 [-1.746] {0.748^{+++}}	-2.411 [-5.583***] {0.236}
OECS						
Antigua & Barbuda	-1.251 [-1.231] {0.676^{++}}	-5.706*** [-5.706***] {0.063}	-0.463 [-1.534] {0.718^{++}}	-5.053*** [-3.821***] {0.085}	-1.146 [-1.114] {0.684^{++}}	-3.200** [-3.200**] {0.123}
Dominica	-2.269 [-2.252] {0.360^{+}}	-5.726*** [-5.740***] {0.210}	-2.895* [-2.934*] {0.584^{++}}	-5.925*** [-4.754***] {0.139}	-1.421 [-1.913] {0.693^{++}}	-6.593*** [-6.541**] {0.289}
Grenada	-0.854 [-1.827] {0.563^{++}}	-4.916*** [-11.166***] {0.500^{++}}	-2.151 [-2.151] {0.720^{++}}	-5.008*** [-6.756***] {0.148}	-0.847 [-0.825] {0.718^{++}}	-2.738* [-0.738*] {0.105}
St. Kitts & Nevis	-2.364 [-2.203] {0.516^{++}}	-4.899*** [-8.976***] {0.244}	-0.889 [-0.705] {0.7043^{++}}	-5.021*** [-5.068***] {0.110}	-1.094 [-1.397] {0.751^{+++}}	-2.833** [-2.833**] {0.169}
St. Lucia	-2.368 [-2.537] {0.706^{++}}	-6.504*** [-6.629***] {0.274}	-2.064 [-2.011] {0.694^{++}}	-4.501*** [-4.708***] {0.208}	-2.182 [-1.948] {0.710^{++}}	-3.687** [-3.738***] {0.397^{+}}
St. Vincent & the Grenadines	-3.256** [-3.222**] {0.228}	-6.023*** [-12.542***] {0.233}	-0.705 [-0.262] {0.712^{++}}	-4.911*** [-5.727***] {0.255}	-0.579 [-0.583] {0.741^{+++}}	-6.459*** [-6.287***] {0.157}
Latin America						
Argentina	-1.825 [-1.824] {0.432^{+}}	-5.327*** [-5.253***] {0.140}	-2.159 [-1.990] {0.386^{+}}	-4.998*** [-5.727***] {0.101}	-1.418 [-1.437] {0.745^{+++}}	-5.480** [-5.406***] {0.141}
Brazil	-2.352 [-2.265] {0.639^{++}}	-4.724*** [-4.678***] {0.414}	-1.570 [-1.645] {0.727^{++}}	-5.272*** [-5.178***] {0.190}	-3.050** [-2.350] {0.760^{+++}}	-3.616*** [-3.664***] {0.424^{+}}

Table A-5 (continued) Results of Tests for Stationarity

	s		i		y	
	Level	Δ	Level	Δ	Level	Δ
Chile	-0.495 [-0.135] {0.599^{++}}	-7.993*** [-8.140***] {0.414}	-0.671 [-0.489] {0.610^{++}}	-6.773*** [-6.969***] {0.219}	-0.836 [-0.668] {0.772^{+++}}	-4.574*** [-4.588***] {0.205+}
Colombia	-1.146 [-1.146] {0.745^{+++}}	-6.207*** [-6.206***] {0.140}	-1.440 [-1.440] {0.750^{+++}}	-5.365*** [-5.368***] {0.146}	-2.313 [-2.828*] {0.797^{+++}}	-4.574*** [-3.527**] {0.525^{++}}
Costa Rico	-1.146 [-0.893] {0.791^{+++}}	-6.275*** [-16.58***] {0.500^{++}}	-0.997 [-0.979] {0.759^{+++}}	-5.847*** [-5.837***] {0.080}	-1.799 [-1.146] {0.797^{+++}}	-4.391*** [-4.391***] {0.184}
Dominican Republic	-0.770 [-0.849] {0.702^{++}}	-9.172*** [-9.299***] {0.081}	-1.515 [-2.091] {0.776^{+++}}	-5.847*** [-8.522***] {0.500^{++}}	-1.322 [-0.855] {0.792^{+++}}	-6.342*** [-6.346***] {0.148}
Ecuador	-1.357 [-1.287] {0.645^{++}}	-5.990*** [-6.013***] {0.131}	-1.666 [-1.581] {0.589^{++}}	-6.614*** [-7.103***] {0.105}	-0.762 [-1.945] {0.792^{+++}}	-4.432*** [-4.481***] {0.358^{+}}
El Salvador	-2.581 [-2.401] {0.486^{++}}	-8.986*** [-13.89***] {0.425^{+}}	-1.225 [-1.307] {0.558^{++}}	-6.614*** [-5.540***] {0.070}	-0.939 [-1.626] {0.658^{++}}	-4.432*** [-2.839*] {0.169}
Guatemala	-2.208 [-2.277] {0.572^{++}}	-7.300*** [-7.315***] {0.229}	-1.307 [-1.307] {0.682^{++}}	-6.990*** [-7.066***] {0.098}	-1.708 [-1.753] {0.784^{+++}}	-2.995** [-2.976**] {0.270}
Honduras	-1.619 [-1.428] {0.714^{++}}	-4.804*** [-4.747***] {0.064}	-1.169 [-1.121] {0.756^{+++}}	-5.826*** [-5.614***] {0.100}	-1.885 [-2.068] {0.802^{+++}}	-2.995** [-4.881***] {0.285}
Mexico	-2.364 [-2.305] {0.706^{++}}	-6.023*** [-6.165***] {0.281}	-1.712 [-1.726] {0.719^{++}}	-6.032*** [-5.614***] {0.167}	-3.169** [-2.948**] {0.787^{+++}}	-4.243*** [-4.233***] {0.514^{++}}
Paraguay	-1.611 [-1.611] {0.480^{++}}	-6.940*** [-6.937***] {0.246}	-1.558 [-1.550] {0.717^{++}}	-4.804*** [-4.846***] {0.412^{+}}	-1.621 [-1.736] {0.784^{+++}}	-3.262** [-3.310**] {0.329}
Peru	-2.016 [-2.120] {0.443^{+}}	-6.100*** [-6.375***] {0.133}	-2.769* [-1.938] {0.586^{++}}	-5.674*** [-7.102***] {0.243}	-1.806 [-2.245] {0.750^{+++}}	-3.262** [-4.180**] {0.251}
Uruguay	-2.407 [-2.407] {0.718^{++}}	-8.482*** [-8.508***] {0.196}	-2.083 [-1.530] {0.507^{++}}	-3.578** [-3.455**] {0.067}	-0.838 [-0.388] {0.764^{+++}}	-4.655*** [-3.155**] {0.067}

Table A-5 (continued) **Results of Tests for Stationarity on the Totals**

	s		i		y	
	Level	Δ	Level	Δ	Level	Δ
Venezuela	-2.505 [-2.677*] {0.177}	-6.972*** [-7.060***] {0.292}	-2.866* [-2.818*] {0.234}	-3.185** [-5.190***] {0.500^{++}}	-1.047 [-1.026] {0.625^{++}}	-4.613*** [4.598***] {0.090}

Notes: the first row for each country gives the ADF test statistic, the second row contains the PP test Statistic in square brackets and the third row shows the KPSS test statistic in curly brackets. *, ** and *** are the MacKinnon critical values for rejection of the null hypothesis of a unit root at the 10%, 5%, and 1% levels, respectively, for both the ADF and PP tests. $^{+}$, $^{++}$, $^{+++}$ are the critical values for the LM test statistic of the KPSS test and denotes rejection of the null hypothesis of stationary at the 10%, 5%, and 1%, respectively (based upon the asymptotic results presented in KPSS 1992 Table 1, pp. 166). Δ denotes the first difference of the original series, *s* is real gross domestic saving, *i* is real gross domestic investment and *y* is real GDP. The variables are in logarithmic form.

Table A-6A Johansen Test for Cointegration between Saving and Investment

		Maximal Eigenvalue		Trace	
Caribbean	**Lags**	***r = 0 vs r = 1***	***r ≤ 1 vs r = 2***	***r = 0 vs r = 1***	***r ≤ 1 vs r = 2***
Barbados	3	16.903**	2.569	19.471**	2.569
Trinidad and Tobago	1	15.286**	1.987	17.273*	1.987
Antigua & Barbuda	1	16.323**	6.792	23.115**	6.792
Grenada	2	25.484**	6.085	31.569**	6.085
St. Kitts and Nevis	1	36.180**	.5712	36.751**	.5712
St. Lucia	2	16.303**	2.971	19.274**	2.971
Latin America					
Argentina	1	18.913**	5.348	24.261**	5.348
Brazil	1	19.760**	6.9390	26.699**	6.939
Chile	1	19.832**	0.115	19.947**	0.115
Colombia	1	16.967**	2.395	19.362*	2.395
Costa Rica	1	18.888*	6.296	25.183*	6.296
Dominican Republic	2	37.627**	9.387	47.014**	9.387
Ecuador	3	21.248**	2.896	24.143*	2.895
El Salvador -*1960-01*	1	8.056	0.620	8.676	0.620
El Salvador -*1980-80*	1	18.482**	5.939	24.421**	5.939
El Salvador -*1981-01*	2	13.395*	0.783	14.178	0.783
Guatemala	1	20.362**	5.147	25.509*	5.147
Honduras	2	26.219**	8.072	34.291**	8.072
Mexico	2	22.787**	1.374	24.161*	1.374
Paraguay	1	42.157**	0.195	42.352**	0.195
Uruguay	2	9.694	2.782	12.475	2.782

Notes: critical values are taken from Pesaran et al. (1996b) and allow for up to five exogenous I(1) variables in the VECM. * and ** denote statistically significant values at the 5% and 10% level, respectively.

Table A-6B Bounds Tests for Cointegration between Saving and Investment

	Regression of i on s			Regression of s on i		
Country	***1***	***2***	***4***	***1***	***2***	***4***
Guyana	7.672**	7.443**	6.106**	2.129	1.971	1.924
Jamaica	9.169**	10.068**	5.150**	2.852	4.117	2.577
Dominica	8.346**	9.806**	2.460	3.616	5.750**	1.749
Peru	6.303**	5.912**	0.822	2.927	3.166	1.963
Venezuela	6.103**	8.612**	3.514	1.782	1.072	1.074

Notes: the relevant critical value bounds are given in Table C1(iii) page 300 (with an unrestricted intercept and no trend; number of regressor = 2), Pesaran et al (2001). They are 3.79 - 4.85 at the 95% significance level and 2.17 - 4.14 at the 90% significance level. * denotes that the F-statistic lies above the 90% upper bound and **denotes above the 95% upper bound.

Table A-7A Johansen Test for Cointegration between Saving and GDP

		Maximal Eigenvalue		Trace	
Caribbean	**Lag length**	***r = 0 vs r = 1***	***r ≤ 1 vs r = 2***	***r = 0 vs r = 1***	***r ≤ 1 vs r = 2***
Barbados	1	11.043	1.237	12.279	1.237
Trinidad and Tobago	1	29.069**	1.341	30.410**	1.341
OECS					
Antigua & Barbuda	1	17.078**	5.635	22.713**	5.635
Dominica	1	28.216**	1.456	29.671**	1.456
Grenada	1	13.644*	0.836	14.480	0.836
St. Kitts and Nevis	2	20.022**	3.306	23.329**	3.306
St. Lucia	1	16.526	4.972	21.498	4.972
Latin America					
Argentina	1	4.250	0.968	5.217	0.968
Brazil	2	17.395*	1.488	18.883	1.4878
Chile	2	4.534	0.053	4.587	0.053
Colombia	1	26.191**	2.881	29.072**	2.881
Costa Rica	1	18.522**	1.711	20.233**	1.711
Dominican Republic	1	23.536**	4.048	27.584**	4.048
Ecuador	1	13.441*	1.419	14.859	1.149
El Salvador	2	10.439	0.552	10.991	0.552
Guatemala	2	27.479**	4.034	31.512	4.034
Honduras	1	6.009	2.911	8.920	2.911
Mexico	1	8.527	4.657	13.184	4.657
Paraguay	1	8.197	1.614	9.811	1.614
Uruguay	1	21.561**	0.075	21.637**	0.075

Notes: same as Table 3.3D.

Table A-7B Bounds Tests for Cointegration between Saving and GDP

	Regression of y on s			Regression of s on y		
	Order of Lag			*Order of Lag*		
Country	***1***	***2***	***4***	***1***	***2***	***4***
Guyana	1.892	1.692	1.782	1.757	2.729	1.845
Jamaica	4.838*	4.381*	3.565	4.0992	3.660	1.780
Peru	1.884	2.347	0.612	1.249	1.671	0.095
Venezuela	0.621	0.337	5.090**	2.362	1.670	2.439

Notes: same as Table 3.3A.

Table A-8A Johansen Test for Cointegration between Investment and GDP

		Maximal Eigenvalue		Trace	
Caribbean	**Lag length**	***r = 0 vs r = 1***	***r ≤ 1 vs r = 2***	***r = 0 vs r = 1***	***r ≤ 1 vs r = 2***
Barbados	1	12.241	0.083	12.324	0.083
Guyana	2	9.464	2.030	11.494	2.030
Trinidad and Tobago	1	20.824**	1.370	22.194**	1.370
OECS					
Antigua & Barbuda	3	14.028*	4.056	18.083**	4.056
Dominica	1	23.400**	7.947*	31.367**	7.947*
Grenada	2	27.953**	0.015	27.968**	0.015
St. Kitts and Nevis	2	11.184	1.128	12.311	1.128
St. Lucia	2	19.774**	1.779	21.553**	1.779
St. Vincent & the Grenadines	2	14.652*	3.813	18.466**	3.813
Latin America					
Argentina	1	5.081	1.125	6.206	1.125
Brazil	2	16.409**	1.283	17.692*	1.283
Chile	2	8.401	0.037	8.438	0.037
Colombia	2	15.715**	4.676	20.391**	4.676
Costa Rica	1	14.022*	5.089	19.111**	5.089
Dominican Republic	1	39.247**	0.809	40.057**	0.809
Ecuador	2	25.340**	2.471	27.811**	2.471
El Salvador	1	35.531**	0.837	36.368**	0.837
Guatemala	2	11.212	0.835	12.047	0.835
Honduras	2	20.134**	3.538	23.672**	3.538
Mexico	2	28.174**	2.447	30.620**	2.447
Paraguay	1	11.423	0.689	12.112	0.689
Peru	3	16.711**	1.236	17.947**	1.236
Uruguay	2	9.077	0.030	9.107	0.030

Notes: same as Table 3.3D.

Table A-8B Bounds Tests for Cointegration between Investment and GDP

	Regression of y on i			Regression of i on y		
	Order of Lag			*Order of Lag*		
Country	***1***	***2***	***4***	***1***	***2***	***4***
Jamaica	3.843	2.609	2.703	2.577	2.050	1.991
Venezuela	3.711	4.226*	1.770	3.750	1.554	1.065

Notes: same as for Table 3.3A.

Table A-9 Cointegration Results between Real Gross Domestic Investment and Saving

Country (1)	Long-run β (2)	Dynamics				Diagnostic tests									
				Wald tests											
		α_1 $gap \rightarrow i$ (3)	α_2 $gap \rightarrow s$ (4)	$\sum\delta_{2i}=0$ $i \rightarrow s$ (5)	$\sum\gamma_{1i}=0$ $s \rightarrow i$ (6)	R_1^2	R^2_2 (7)	SC_1	SC_2 (8)	FF_1	FF_2 (9)	N_1	N_2 (10)	DW_1	DW_2 (11)
Caribbean															
Barbados	0.201 (0.04)	-0.326 (0.001)	0.140 (0.349)	0.349 (0.555)	1.266 (0.260)	0.72	0.49	1.66 (0.20)	0.02 (0.98)	0.22 (0.64)	0.10 (0.75)	1.52 (0.97)	0.56 (0.76)	1.60	1.98
Guyana[a]	0.407 (0.000)	-0.472 (0.000)	0.379 (0.409)	0.518 (0.472)	0.385- (0.058)	0.43	0.28	0.07 (0.79)	2.03 (0.16)	1.82 (1.77)	3.53 (0.06)	1.72 (0.42)	5.18 (0.07)	1.86	1.80
Jamaica[a]	0.570 (0.000)	-0.319 (0.000)	NA	0.091 (0.763)	0.033- (0.856)	0.87	0.10	0.00 (0.96)	0.67 (0.41)	2.21 (0.14)	0.01 (0.95)	1.30 (0.52)	0.87 (0.65)	1.91	2.24
Trinidad & Tobago	0.986 (0.000)	-0.427 (0.007)	0.184 (0.307)	No lags	No lags	0.19	0.03	0.06 (0.80)	0.01 (0.98)	0.03 (0.77)	1.86 (0.17)	0.46 (0.80)	0.05 (0.98)	2.07	1.99
OECS															
Antigua & Barbuda	0.611[r] (0.00)	-0.045 (0.601)	-0.354 (0.009)	No lags	No lags	0.54	0.41	1.70 (0.20)	0.34 (0.56)	0.20 (0.66)	0.20 (0.66)	0.34 (0.84)	0.77 (0.88)	1.56	1.71
Dominica	0.193 (0.018)	-0.754 (0.001)	0.473 (0.393)	1.269 (0.260)	0.269 (0.604)	0.43	0.14	3.40 (0.07)	0.27 (0.53)	0.01 (0.91)	1.07 (0.30)	4.74 (0.09)	3.98 (0.14)	2.31	2.10
Grenada	0.480 (0.000)	-0.308 (0.001)	0.536 (0.193)	0.571 (0.450)	0.010 (0.752)	0.73	0.41	0.01 (0.91)	2.21 (0.14)	2.84 (0.09)	2.48 (0.12)	2.77 (0.25)	0.01 (0.99)	1.73	2.06
St. Kitts & Nevis	0.752[r] (0.000)	0.040 (0.755)	-0.814 (0.000)	No lags	No lags	0.05	0.78	0.01 (0.91)	0.37 (0.54)	0.04 (0.85)	0.26 (0.61)	2.08 (0.35)	0.58 (0.75)	1.81	1.66
St Lucia	0.603 (0.000)	-0.426 (0.000)	0.144 (0.538)	0.110 (0.740)	2.571 (0.109)	0.51	0.60	0.00 (1.00)	0.12 (0.91)	1.66 (0.20)	0.98 (0.32)	0.09 (0.96)	0.53 (0.77)	1.98	2.01
St. Vincent & the Gren.	none	No cointegration		NA	NA	NA		NA		NA		NA		NA	

Table A-9 (continued) Cointegration Results between Real Gross Domestic Investment and Saving

Country (1)	Long-run β (2)	Dynamics: α_1 $gap \rightarrow i$ (3)	Dynamics: α_2 $gap \rightarrow s$ (4)	Wald tests: $\sum\delta_{2i}=0$ $i \rightarrow s$ (5)	Wald tests: $\sum\gamma_{1i}=0$ $s \rightarrow i$ (6)	Diagnostic tests: R_1^2 R_2^2 (7)	SC_1 SC_2 (8)	FF_1 FF_2 (9)	N_1 N_2 (10)	DW_1 DW_2 (11)
Latin America										
Argentina	0.741[r] (0.000)	-0.218 (0.388)	-0.469 (0.002)	No lags	No lags	0.19 0.44	3.08 (0.08) 0.07 (0.80)	0.01 (0.91) 2.12 (0.15)	1.47 (0.93) 1.14 (0.56)	1.45 1.91
Brazil	0.722 (0.000)	-0.646 (0.000)	-0.398 (0.007)	No lags	No lags	0.67 0.56	1.07 (0.30) 0.14 (0.70)	0.08 (0.78) 1.74 (0.19)	0.77 (0.68) 0.17 (0.92)	1.73 1.86
Chile	0.948 (0.000)	-0.489 (0.002)	0.142 (0.234)	No lags	No lags	0.28 0.52	0.32 (0.57) 0.20 (0.66)	0.40 (0.53) 0.15 (0.70)	0.06 (0.52) 0.71 (0.70)	2.11 2.05
Colombia	0.777 (0.000)	-0.147 (0.000)	-0.095 (0.026)	No lags	No lags	0.70 0.42	1.09 (0.30) 0.12 (0.73)	0.04 (0.84) 0.03 (0.86)	1.79 (0.40) 1.13 (0.57)	2.27 1.86
Costa Rica	0.493[r] (0.000)	-0.005 (0.967)	-0.711 (0.009)	No lags	No lags	0.20 0.36	1.20 (0.27) 0.17 (0.67)	1.76 (0.19) 0.88 (0.35)	0.92 (0.63) 0.32 (0.85)	2.30 1.90
Dominican Republic	0.507 (0.000)	-0.419 (0.000)	0.238 (0.131)	1.269 (0.260)	8.873- (0.003)	0.73 0.56	0.90 (0.34) 0.53 (0.47)	0.28 (0.60) 1.46 (0.23)	0.83 (0.66) 1.93 (0.38)	1.75 2.14
Ecuador	1.029[r] (0.000)	0.196 (0.178)	-0.895 (0.000)	10.95- (0.001)	0.182 (0.670)	0.76 0.46	1.87 (0.17) 0.04 (0.85)	3.89 (0.05) 0.38 (0.54)	1.76 (0.42) 0.68 (0.71)	2.28 2.06
El Salvador *1960-2001*	none	No cointegration		0.538 (0.463)	0.928 (0.335)	0.14 0.83	0.97 (0.33) 3.08 (0.08)	0.19 (0.66) 0.70 (0.40)	0.56 (0.76) 0.22 (0.90)	1.88 2.43
El Salvador *1960-1980*	0.875[r] (0.000)	0.305 (0.330)	-0.804 (0.006)	No lags	No lags	0.19 0.83	1.09 (0.30) 1.15 (0.28)	3.32 (0.07) 2.85 (0.09)	1.85 (0.40) 0.91 (0.63)	1.29 1.53
El Salvador *1981-2001*	none	No cointegration		0.424 (0.515)	1.250 (0.263)	0.37 0.86	0.05 (0.82) 3.85 (0.05)	0.53 (0.47) 0.78 (0.38)	1.56 (0.46) 0.79 (0.68)	1.88 2.59
Guatemala	0.853 (0.000)	-0.589 (0.008)	0.122 (0.531)	No lags	No lags	0.17 0.04	0.05 (0.82) 0.44 (0.51)	0.76 (0.39) 0.02 (0.87)	0.18 (0.92) 0.71 (0.70)	1.93 2.13

Table A-9 (continued) Cointegration Results between Real Gross Domestic Investment and Saving

Country (1)	Long-run β (2)	Dynamics				Diagnostic tests									
				Wald tests											
		α_1 $gap \rightarrow i$ (3)	α_2 $gap \rightarrow s$ (4)	$\sum \delta_{2i} = 0$ $i \rightarrow s$ (5)	$\sum \gamma_{1i} = 0$ $s \rightarrow i$ (6)	R_1^2 (7)	R^2_2	SC_1 (8)	SC_2	FF_1 (9)	FF_2	N_1 (10)	N_2	DW_1 (11)	DW_2
Honduras	0.772 (0.000)	-0.786 (0.000)	0.208 (0.452)	1.261 (0.261)	0.007 (0.979)	0.39	0.08	2.33 (0.13)	0.00 (0.98)	0.13 (0.72)	0.04 (0.84)	0.24 (0.89)	1.70 (0.43)	1.81	1.92
Mexico	0.734 (0.000)	-0.193 (0.045)	0.114 (0.190)	2.637 (0.104)	3.451 (0.063)	0.77	0.53	1.14 (0.29)	0.22 (0.64)	2.74 (0.10)	0.51 (0.47)	3.18 (0.20)	1.19 (0.55)	2.06	1.72
Paraguay	0.634 (0.000)	-0.205 (0.000)	-0.502 (0.000)	No lags	No lags	0.78	0.81	0.25 (0.62)	2.02 (0.22)	1.29 (0.26)	1.49 (0.22)	0.62 (0.74)	2.25 (0.33)	1.79	2.27
Peru[a]	0.838 (0.000)	-0.528 (0.004)	-0.114 (0.523)	0.582 (0.445)	0.515 (0.473)	0.38	0.15	0.01 (0.91)	1.01 (0.31)	0.17 (0.68)	1.46 (0.23)	1.30 (0.52)	0.45 (0.80)	1.97	2.11
Uruguay	none	No cointegration		0.304 (0.582)	0.016 (0.900)	0.24	0.08	0.81 (0.37)	1.32 (0.25)	0.00 (0.99)	0.13 (0.72)	1.16 (0.56)	1.80 (0.41)	1.82	1.72
Venezuela	0.134 (0.006)	-0.861 (0.002)	0.090 (0.523)	3.484 (0.062)	0.439 (0.508)	0.46	0.17	2.64 (0.11)	1.27 (0.26)	0.66 (0.42)	1.77 (0.18)	0.74 (0.69)	0.48 (0.79)	2.10	2.06

Notes: p-values are in parentheses. The estimates are from the VECM represented by equation 3.8 where the subscripts 1 and 2 refer to the investment equation and saving equation, respectively. Hence, β is the long-run elasticity of gross domestic investment with respect to gross domestic saving, however, an *r* beside the coefficient denotes that it refers to the opposite i.e. the long-run elasticity of gross domestic saving with respect to gross domestic investment. *SC* is the Lagrange multiplier test of residual serial correlation (Chi-square of degree 1). *FF* is the Ramsey's RESET test for incorrect functional form using the square of the fitted values (Chi-square of degree 1). *N* is the test for normality of the residuals based on the Jarque-Bera test statistic (Chi-square of degree 1). *DW* is the Durbin-Watson statistic. *a* – indicates that the estimation technique is ARDL. * indicates that the value is not significantly different from 1. Finally, *gap* represents deviation from long-run equilibrium and the respective α indicates (by its level of significance), which variable is responding to *gap* to restore the defined equilibrium. For example, a significant α_1 implies that the gap is defined as $i - s$. A positive (negative) gap exists if saving has fallen (risen) relative to investment in which case investment must fall (rise) to restore equilibrium and positive long run causality is said to run from saving to investment. Note that saving is the forcing variable in the relation. The reverse analysis holds when α_2 is significant.

Table A-10 Cointegration Results between Real Gross Domestic Saving and Real GDP

Country (1)	Long-run β (2)	Dynamics: α_1 $gap \rightarrow s$ (3)	Dynamics: α_2 $gap \rightarrow g$ (4)	Wald tests: $\sum \delta_{2i} = 0$ $s \rightarrow g$ (5)	Wald tests: $\sum \gamma_{1i} = 0$ $g \rightarrow s$ (6)	Diagnostic tests: R_1^2 R^2_2 (7)	SC_1 SC_2 (8)	FF_1 FF_2 (9)	N_1 N_2 (10)	DW_1 DW_2 (11)
Caribbean										
Barbados	none	No cointegration		2.77- (0.096)	0.001 (0.981)	0.54 0.22	2.59 (0.11) 0.79 (0.37)	0.57 (0.45) 0.39 (0.53)	0.52 (0.77) 0.99 0.61)	2.31 1.87
Guyana[a]	none	No cointegration		0.418 (0.517)	4.144+ (0.042)	0.40 0.42	0.03 (0.77) 2.80 (0.09)	0.17 (0.68) 1.28 (0.26)	0.95 (0.62) 0.27 (0.87)	2.02 1.67
Jamaica[a]	0.67[r] (0.001)	NA	-0.118 (0.000)	No lags	No lags	0.33 0.74	0.96 (0.33) 0.04 (0.84)	0.08 (0.78) 0.60 (0.44)	1.05 (0.59) 3.59 (0.17)	2.31 1.90
Trinidad & Tobago	0.59[r] (0.000)	0.366 (0.075)	-0.154 (0.000)	No lags	No lags	0.08 0.44	0.31 (0.58) 2.07 (0.15)	0.20 (0.66) 0.02 (0.90)	0.69 (0.71) 2.01 (0.37)	1.87 2.41
OECS										
Antigua & Barbuda	1.30 (0.000)	-0.250 (0.014)	-0.091 (0.001)	No lags	No lags	0.20 0.07	1.97 (0.16) 0.77 (0.38)	0.14 (0.16) 0.00 (0.96)	0.34 (0.84) 0.50 (0.78)	2.31 2.01
Dominica	0.127[r] (0.000)	-0.133 (0.882)	-0.273 (0.000)	No lags	No lags	0.59 0.88	1.11 (0.29) 0.11 (0.74)	1.05 (0.31) 2.26 (0.13)	5.68 (0.06) 1.15 (0.56)	1.93 1.81
Grenada	2.367 (0.000)	-0.880 (0.001)	-0.013 (0.448)	No lags	No lags	0.40 0.03	0.18 (0.68) 1.40 (0.24)	2.98 (0.08) 1.27 (0.72)	0.14 (0.94) 3.22 (0.20)	1.77 1.28
St. Kitts & Nevis	1.193 (0.000)	-0.755 (0.000)	-0.026 (0.297)	0.005 (0.944)	1.761 (0.184)	0.85 0.29	1.24 (0.27) 0.79 (0.37)	3.30 (0.07) 0.68 (0.41)	0.27 (0.88) 0.68 (0.71)	1.47 1.73
St Lucia	none	No cointegration		0.006 (0.981)	0.056 (0.813)	0.08 0.08	0.01 (0.91) 0.10 (0.76)	3.43 (0.06) 0.11 (0.75)	0.49 (0.79) 2.20 (0.33)	2.02 1.90

Table A-10 (continued) **Cointegration Results between Real Gross Domestic Saving and Real GDP**

Country (1)	Long-run β (2)	Dynamics: α_1 $gap \rightarrow s$ (3)	Dynamics: α_2 $gap \rightarrow y$ (4)	Wald tests: $\sum \delta_{2i} = 0$ $s \rightarrow y$ (5)	Wald tests: $\sum \gamma_{1i} = 0$ $y \rightarrow s$ (6)	Diagnostic tests: R_1^2 R_2^2 (7)	SC_1 SC_2 (8)	FF_1 FF_2 (9)	N_1 N_2 (10)	DW_1 DW_2 (11)
Latin America										
Argentina	none	No cointegration		No lags	No lags	na	na	na	na	na
Brazil	none	No cointegration		0.524 (0.469)	12.21+ (0.000)	0.49 0.58	0.03 (0.77) 0.04 (0.84)	0.17 (0.68) 0.88 (0.35)	0.95 (0.62) 0.69 (0.71)	2.27 1.85
Chile	none	No cointegration		5.685+ (0.017)	0.078 (0.780)	0.41 0.68	2.43 (0.12) 0.17 (0.68)	0.46 (0.50) 5.43 (0.02)	2.80 (0.25) 1.40 (0.50)	1.67 2.07
Colombia	0.859[r] (0.000)	0.072 (0.492)	-0.087 (0.000)	No lags	No lags	0.02 0.34	0.07 (0.80) 1.28 (0.26)	1.61 (0.21) 1.40 (0.24)	0.38 (0.83) 0.43 (0.81)	1.92 1.64
Costa Rica	1.33 (0.000)	-0.637 (0.000)	-0.024 (0.312)	No lags	No lags	0.44 0.42	0.00 (0.93) 0.02 (0.88)	1.17 (0.28) 0.01 (0.92)	0.39 (0.98) 1.59 (0.45)	1.94 1.77
Dominican Republic	1.119 (0.000)	-0.563 (0.000)	-0.041 (0.146)	No lags	No lags	0.69 0.36	2.91 (0.09) 0.63 (0.43)	1.13 (0.29) 0.08 (0.78)	0.01 (1.00) 2.85 (0.24)	2.39 1.69
Ecuador	none	No cointegration		No lags	No lags	na	na	na	na	na
El Salvador	none	No cointegration		0.606 (0.436)	7.998+ (0.005)	0.88 0.87	4.27 (0.04) 0.17 (0.89)	0.04 (0.84) 1.13 (0.29)	1.10 (0.25) 0.17 (0.92)	2.49 1.93
Guatemala	0.416[r] (0.000)	0.832 (0.212)	-0.248 (0.006)	7.455- (0.006)	3.424+ (0.064)	0.23 0.60	0.74 (0.39) 0.54 (0.46)	0.72 (0.40) 3.57 (0.06)	3.07 (0.22) 0.81 (0.67)	2.04 2.13
Honduras	none	No cointegration		No lags	No lags	na	na	na	na	na
Mexico	none	No cointegration		0.045 (0.832)	0.034 (0.854)	0.51 0.56	4.27 (0.04) 1.15 (0.28)	0.04 (0.84) 0.14 (0.71)	1.10 (0.25) 0.52 (0.77)	1.60 1.78

Table A-10 (continued) **Cointegration Results between Real Gross Domestic Saving and Real GDP**

Country (1)	Long-run β (2)	Dynamics				Diagnostic tests				
				Wald tests						
		α_1 $gap \rightarrow s$ (3)	α_2 $gap \rightarrow y$ (4)	$\sum \delta_{2i} = 0$ $s \rightarrow y$ (5)	$\sum \gamma_{1i} = 0$ $y \rightarrow s$ (6)	R_1^2 R^2_2 (7)	SC_1 SC_2 (8)	FF_1 FF_2 (9)	N_1 N_2 (10)	DW_1 DW_2 (11)
Paraguay	none	No cointegration		No lags	No lags	na	na	na	na	na
Peru	none	No cointegration		No lags	No lags	na	na	na	na	na
Uruguay	1.031 (0.000)	-0.519 (0.000)	0.025 (0.377)	No lags	No lags	0.41	0.46	0.01 (0.92)	1.78 (0.18)	1.41 (0.23)	0.60 (0.44)	3.37 (0.19)	0.70 (0.70)	1.84	1.54
Venezuela	none	No cointegration		No lags	No lags	na	na	na	na	na

Notes: same as Table 3.4A, however the subscripts 1 and 2 refer to the saving equation and growth equation, respectively. Hence, β is the long-run elasticity of gross domestic saving with respect to GDP, but, an *r* beside the coefficient denotes that it refers to the opposite, i.e. the long-run elasticity of GDP with respect to gross domestic saving.

Table A-11 Cointegration Results between Real Gross Domestic Investment and Real GDP

Country (1)	Long-run β (2)	Dynamics: α_1 $gap \rightarrow i$ (3)	Dynamics: α_2 $gap \rightarrow y$ (4)	Wald tests: $\sum\delta_{2i}=0$ $i \rightarrow y$ (5)	Wald tests: $\sum\gamma_{1i}=0$ $y \rightarrow i$ (6)	Diagnostic tests: R_1^2 R^2_2 (7)	SC_1 SC_2 (8)	FF_1 FF_2 (9)	N_1 N_2 (10)	DW_1 DW_2 (11)
Caribbean										
Barbados	None	No cointegration		No lags	No lags	na	na	na	na	na
Guyana	none	No cointegration		2.65 (0.103)	0.476 (0.490)	0.05 0.45	0.02 (0.89) 0.91 (0.34)	0.00 (0.98) 0.05 (0.82)	1.91 (0.39) 0.70 (0.74)	1.95 1.79
Jamaica	None	No cointegration		na	na	na	na	na	na	na
Trinidad & Tobago	0.595[r] (0.000)	0.285 (0.110)	-0.123 (0.000)	No lags	No lags	0.60 0.31	0.00 (0.99) 0.22 (0.64)	0.47 (0.49) 1.47 (0.23)	0.93 (0.63) 1.14 (0.57)	2.00 2.10
OECS										
Antigua & Barbuda	1.419 (0.000)	-0.873 (0.003)	-0.044 (0.609)	0.174 (0.677)	0.007 (0.932)	0.80 0.74	0.44 (0.51) 0.40 (0.53)	0.00 (0.97) 0.05 (0.82)	1.22 (0.54) 3.22 (0.20)	2.13 2.06
Dominica	0.115[r] (0.000)	-0.168 (0.306)	-0.121 (0.000)	No lags	No lags	0.08 0.80	0.10 (0.75) 0.28 (0.60)	1.02 (0.31) 1.08 (0.30)	0.36 (0.84) 0.90 (0.64)	2.11 1.66
Grenada	1.447 (0.000)	-0.741 (0.000)	0.004 (0.918)	0.409 (0.523)	0.259 (0.610)	0.86 0.49	2.05 (0.15) 0.74 (0.39)	0.00 (0.99) 0.06 (0.81)	1.88 (0.39) 1.11 (0.57)	2.41 2.17
St. Kitts & Nevis	none	No cointegration		0.137 (0.712)	3.342+ (0.068)	0.14 0.20	0.12 (0.73) 0.96 (0.33)	0.11 (0.74) 0.23 (0.63)	1.58 (0.45) 1.00 (0.61)	1.89 1.73
St Lucia	1.364 (0.000)	-0.921 (0.000)	-0.055 (0.553)	0.597 (0.440)	8.022- (0.005)	0.58 0.10	0.00 (0.96) 0.08 (0.78)	0.17 (0.68) 0.32 (0.57)	1.20 (0.55) 0.92 (0.63)	1.90 1.75
St. Vincent & the Gren.	0.795 (0.001)	-0.554 (0.009)	-0.061 (0.049)	5.124+ (0.024)	3.743- (0.053)	0.39 0.77	0.92 (0.34) 0.86 (0.35)	0.00 (0.96) 2.25 (0.13)	0.74 (0.69) 0.26 (0.88)	1.77 2.28

Table A-11 (continued) Cointegration Results between Real Gross Domestic Investment and Real GDP

Country (1)	Long-run β (2)	Dynamics				Diagnostic tests									
				Wald tests											
		α_1 $gap \rightarrow i$ (3)	α_2 $gap \rightarrow y$ (4)	$\sum \delta_{2i} = 0$ $i \rightarrow y$ (5)	$\sum \gamma_{1i} = 0$ $y \rightarrow i$ (6)	R_1^2	R^2_2 (7)	SC_1	SC_2 (8)	FF_1	FF_2 (9)	N_1	N_2 (10)	DW_1	DW_2 (11)
Latin America															
Argentina	none	No cointegration		No lags	No lags	na		na		na		na		na	
Brazil	1.126 (0.000)	-0.451 (0.001)	-0.006 (0.899)	3.050- (0.081)	15.34+ (0.000)	0.65	0.64	1.15 (0.28)	1.87 (0.17)	3.27 (0.07)	0.23 (0.63)	1.38 (0.50)	1.58 (0.45)	2.04	1.61
Chile	none	No cointegration		0.708 (0.400)	12.40+ (0.000)	0.49	0.58	0.01 (0.94)	0.00 (0.99)	0.03 (0.86)	1.37 (0.24)	3.34 (0.63)	0.64 (0.73)	1.96	1.98
Colombia	1.103 (0.000)	-0.353 (0.003)	-0.003 (0.891)	1.106 (0.293)	0.181 (0.670)	0.60	0.48	0.00 (0.96)	0.37 (0.55)	1.79 (0.18)	0.12 (0.73)	1.22 (0.54)	0.27 (0.87)	1.93	2.08
Costa Rica	1.331 (0.000)	-0.279 (0.033)	0.031 (0.247)	No lags	No lags	0.37	0.54	2.39 (0.12)	0.06 (0.80)	0.19 (0.67)	1.33 (0.25)	1.73 (0.42)	1.16 (0.56)	2.34	1.88
Dominican Republic	1.125 (0.000)	-0.675 (0.000)	-0.124 (0.000)	No lags	No lags	0.78	0.57	0.51 (0.47)	3.38 (0.07)	0.05 (0.83)	0.28 (0.59)	0.26 (0.88)	4.35 (0.11)	1.79	1.42
Ecuador	0.924 (0.000)	-0.296 (0.004)	0.030 (0.046)	0.044 (0.833)	6.096+ (0.014)	0.68	0.87	4.29 (0.04)	1.16 (0.28)	0.08 (0.77)	1.72 (0.19)	3.05 (0.21)	0.31 (0.86)	1.30	1.67
El Salvador	1.687 (0.000)	-0.258 (0.000)	0.068 (0.000)	No lags	No lags	0.36	0.83	0.01 (0.93)	0.40 (0.53)	0.00 (0.95)	0.13 (0.59)	0.08 (0.96)	0.99 (0.61)	1.95	2.05
Guatemala	none	No cointegration		0.707 (0.400)	5.247+ (0.022)	0.22	0.40	2.65 (0.10)	3.41 (0.07)	0.14 (0.71)	1.70 (0.19)	0.97 (0.62)	2.28 (0.32)	1.74	1.72
Honduras	1.282 (0.000)	-0.404 (0.004)	-0.006 (0.795)	0.254 (0.615)	7.297+ (0.007)	0.62	0.17	0.01 (0.93)	0.14 (0.70)	0.02 (0.90)	2.79 (0.10)	1.18 (0.56)	1.52 (0.47)	1.94	2.02
Mexico	1.055 (0.000)	-0.276 (0.015)	0.019 (0.566)	2.653 (0.103)	3.857+ (0.050)	0.76	0.69	0.16 (0.69)	0.34 (0.56)	2.67 (0.10)	1.02 (0.31)	1.04 (0.59)	0.95 (0.62)	1.92	1.90

Table A-11 (continued) Cointegration Results between Real Gross Domestic Investment and Real GDP

Country (1)	Long-run β (2)	Dynamics				Diagnostic tests									
				Wald tests											
		α_1 $gap \rightarrow i$ (3)	α_2 $gap \rightarrow y$ (4)	$\sum \delta_{2i} = 0$ $i \rightarrow y$ (5)	$\sum \gamma_{1i} = 0$ $y \rightarrow i$ (6)	R_1^2 (7)	R^2_2	SC_1 (8)	SC_2	FF_1 (9)	FF_2	N_1 (10)	N_2	DW_1 (11)	DW_2
Paraguay	none	No cointegration		0.734 (0.391)	0.846 (0.358)	0.54	0.44	1.45 (0.23)	0.00 (1.00)	0.38 (0.54)	0.18 (0.67)	0.21 (0.90)	5.27 (0.07)	2.15	1.79
Peru	0.731 (0.000)	-0.527 (0.000)	-0.035 (0.205)	0.005 (0.943)	0.035 (0.851)	0.51	0.67	0.73 (0.39)	0.12 (0.73)	1.23 (0.27)	2.56 (0.11)	2.53 (0.28)	0.38 (0.83)	1.86	2.06
Uruguay	none	No cointegration		0.330 (0.566)	6.495+ (0.011)	0.50	0.50	1.23 (0.27)	0.58 (0.45)	0.22 (0.64)	0.14 (0.70)	1.39 (0.50)	0.39 (0.82)	1.70	1.74
Venezuela	none	No cointegration		No lags	No lags	na		na		na		na		na	

Notes: same as Table 3.4A, however the subscripts 1 and 2 refer to the investment equation and growth equation, respectively. Hence, β is the long-run elasticity of gross domestic investment with respect to GDP; but, an *r* beside the coefficient denotes that it refers to the opposite, i.e. the long-run elasticity of GDP with respect to gross domestic investment.