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What is the Relationship between National Saving and Investment in Latin America and the Caribbean?

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Abstract*

Using panel co-integration techniques and a comprehensive dataset covering the period 1980-2013, this paper finds a positive and significant correlation between national saving and domestic investment rates in Latin America and the Caribbean (LAC). The estimated correlation is approximately 0.39; i.e., for every 1 percentage point of GDP increase in national saving, domestic investment increases by 0.39 percentage points on average. There are however, three nuances to the headline result: i) the estimated correlation has been declining over time; ii) the regional average hides a large degree of intra-regional heterogeneity; and iii) the estimated coefficient is largest amongst the biggest economies in the region. It is concluded that low national saving rates remain a binding constraint for capital accumulation in LAC.

JEL classifications: C23, E2, F36
Keywords: Saving, Investment, Feldstein-Horioka puzzle, Panel cointegration

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1. Introduction

Countries invest in physical capital in order to grow. The process of capital formation, in turn, requires financing. This financing can come from national sources, via national saving, and/or from external sources via the absorption of foreign saving (i.e., net capital inflows). In Latin America and the Caribbean (LAC), national saving rates are significantly lower than in other emerging regions, in particular the high investment/high growth East-Asian countries.[1] Perhaps not surprisingly, investment rates are also significantly lower: while countries in LAC invest on average less than 20 percent of GDP per year, countries in Emerging Asia invest close to 30 percent on average.[2] According to the Commission on Growth and Development (2008) report, it appears that overall investment rates of 25 percent of GDP or more are needed to back up strong economic growth. Low investment rates in LAC are therefore a binding constraint on growth.

From a policy standpoint, a relevant question is the following: if countries in LAC want to increase investment rates, can they do it without increasing national saving? The only way to do so would be to increase the absorption of foreign saving.[3] In fact, over the last three decades, many countries in the LAC region have sought to increase financial integration in order to relax the financing constraint imposed by the low national saving rates. In this paper we empirically assess to what extent these efforts have changed the estimated relationship between national saving and domestic investment in the region.

In an influential paper published in 1980, Feldstein and Horioka set forth one of the major puzzles in open economy macroeconomics (Obstfeld and Rogoff, 2001). They found a positive and significant correlation between national saving and domestic investment rates in a cross-section of 13 OECD countries. In fact, the correlation coefficient was found to be close to 1, suggesting that for every 1 percentage point increase in national saving (as a percentage of GDP), domestic investment increased by the same amount, meaning almost full "saving retention" within these economies. This constituted a puzzle because, in open economies, if

[1] According to data from the World Economic Outlook database, over the last 30 years, national saving rates in LAC have been practically stagnant at approximately 20 percent of GDP, while in Emerging Asia saving rates have increased by 6.5 percentage points to 35 percent of GDP over the same period.

[2] The variable used in national accounts to measure investment is "Gross Fixed Capital Formation" (GFKF). GFKF is a component of Gross Domestic Product (GDP). It includes physical capital investment (i.e., machinery, plants, infrastructure, etc.) plus investments in commercial and residential dwellings.

[3] In this paper, we abstract from the debate on whether, even if in principle feasible, financing investment via absorption of foreign savings alone is desirable from a macroeconomic standpoint. As discussed in the Commission on Growth and Development report (2008) and also IDB (2013), there are limits to the ability to absorb foreign saving, because foreign borrowing is risky.

national saving were added to a world saving pool and domestic investment competed for funds from the same world saving pool without impediments, there should be no correlation between a country's saving rate and its rate of investment (Feldstein and Bacchetta, 1991). The counterfactual empirical result revealed that effective financial integration across OECD countries was lower than previously thought.

After the initial contribution, numerous studies have tried to re-estimate the relationship in various forms. Some authors have expanded the original sample of countries including developing countries; other studies have estimated the relationship using different time periods; and some authors have sought to estimate relationship using time series rather than purely cross-section analysis.[4] While the original results showing a high and positive correlation coefficient between national saving and domestic investment have become a well-established fact, the interpretation as to what is behind the estimated correlation remains disputed. Among the competing explanations, Martin Feldstein and coauthors have emphasized the role of imperfect capital mobility across countries: i.e., cross-border obstacles to financial integration are sufficiently large that investment is crowded-in domestically whenever national saving rises. Thus, the positive estimated correlation between national saving and investment reveals real impediments to financial integration across countries.[5]

There are two sources of criticism of the Feldstein and Horioka-type of estimates. The first is that the estimated relationship between the series may be spurious if investment and saving are correlated with omitted variables that are very hard to account for in pure cross-section analysis. This has compelled many authors to re-estimate the relationship between national saving and investment exploiting time-series variation as well as cross-country variation in the data using panel datasets, as panel data estimation techniques provide a way to account for unobservable heterogeneity across countries. The second source of criticism is, however, that exploiting the time-series variation of data in panel regressions poses its own estimation challenges. In particular, the national saving and investment series are likely to be non-

[4] For literature surveys, see Tesar (1991), Coakley, Kulasi and Smith (1998) and Apergis and Tsoumas (2009).

[5] Consistent with this view, Bayoumi (1990) found that the correlation fell over time as countries gradually became more financially integrated. Moreover, Feldstein and Bacchetta (1991) rejected competing explanations, such as that the high estimated correlation reflected a spurious impact of omitted variables (for example: economic growth). They also rejected the hypothesis that the high estimated saving retention coefficient reflected an endogenous response of fiscal policy to external account imbalances (Summers, 1988).

stationary, leading to problems of cointegration in panel.[6] Moreover, as Feldstein and Horioka (1980) have emphasized, the close relationship between national saving and domestic investment is a long-term characteristic and may not hold from year to year. This implies that, when annual panel data are used, the simple correlation between the series is likely to be much lower than in cross-section analyses. Therefore, it is necessary to employ techniques that allow searching for the long-term relationship between the variables in time series.

In order to address these problems, we estimate the Feldstein-Horioka coefficient for the LAC countries using Pedroni's (1999, 2000, 2001, 2004) panel cointegration techniques. This methodology allows finding the long-term relationship between the series of interest in the presence of the estimation challenges posed by cointegration in panel. By applying that methodology, we can estimate how the relationship between national saving and investment has changed over time, and also compare the estimated coefficients across sub-regions in LAC. Moreover, the methodology exploits the full extent of the cross-sectional and time-series dimensions of the data. In particular, we estimate the long-run relationship between national saving and investment in LAC employing the most comprehensive data available for the relevant series.

Our paper is related to Murthy (2008), who estimated the Feldstein-Horioka coefficient for the LAC region using a similar approach but a different sample. He obtained an estimated correlation coefficient of approximately 0.50. This is slightly higher than our baseline estimation (0.39), the difference coming most likely from the different samples used. However, we depart from Murthy's paper by exploring the dynamics of the estimated relationship. That is, in addition to estimating a single panel coefficient for the region, we also study how the coefficient estimate has changed over time and how it differs across sub-regions within LAC as well as across individual countries in the region. Moreover, we compare the coefficient estimate for LAC to other regions in the world.

We find that the estimated correlation between national saving and investment in the region is approximately 0.39; i.e., for every 1 percentage point increase in national saving, domestic investment increases by 0.39 percentage points, on average. There are, however, three nuances to the headline result: i) for the whole region, the estimated correlation has declined

[6] See for example, Kim, Oh, and Jeong (2005); Bahmani-Oskooee and Chakrabarti (2005), Murthy (2008), and Kumar and Rao (2011).

from close to 0.60 in the 1980s to less than 0.30 over the last decade; ii) the regional average hides a large degree of intra-regional heterogeneity, with a higher correlation coefficient estimated for larger economies;[7] and iii) the declining regional average is driven more by the smaller countries in Central America and the Caribbean.

We conclude that, to the extent that the estimated correlation coefficient reflects real impediments to the movement of capital, the results show that financial integration in LAC remains imperfect and incomplete. Therefore, mobilizing national saving remains a key policy challenge to support capital accumulation in the region.

2. Methodology and Data

The starting point in the analysis is the basic equation that was estimated by Feldstein-Horioka (1980). Consider the following variant of the equation:

$$\frac{I_{i,t}}{Y_{i,t}} = \alpha_i + \tau_t + \beta * \frac{S_{i,t}}{Y_{i,t}} + \varepsilon_{i,t} \qquad (1)$$

where $I_{i,t}$ is the investment of country i in year t, $Y_{i,t}$ is the GDP, $S_{i,t}$ is national savings, and $\varepsilon_{i,t}$ is the stochastic error term. α_i is the country-specific constant of the model, and τ_t is a period fixed-effect. This specification allows for time- and individual-fixed effects. In the 1980 paper, Feldstein and Horioka took within-country averages of the variables in equation (1) for a sample of OECD countries collapsing the sample to a cross-section. Instead, we estimate (1) in panel.

The term of interest is β, also known as the "saving retention" coefficient, because under the interpretation provided by Feldstein and Horioka, it provides an estimate of the amount by which higher national saving may raise domestic investment.

We estimate (1) using Pedroni's (1999, 2000) group-mean fully modified OLS (GM-FMOLS) panel method. This methodology permits estimating the relationship taking into account that the underlying series may be first-order integrated *I*(1) and cointegrated in panel. Two time series are cointegrated if they are individually non-stationary, for example *I*(1), but there is a (cointegrating) vector in common that forms a stationary linear combination of them.

[7] This result in particular resonates with the theoretical insights of the model of Baxter and Crucini (1993). They show that country size is an important determinant of the saving-investment correlations, with higher predicted correlations for larger economies.

Some previous studies, using different samples, have provided evidence that national saving and investment series are non-stationary and cointegrated.[8] This is not surprising because the difference between the two series is the current account balance, which is a time series that is usually stationary (i.e., countries cannot become further indebted forever).

In order to show this, consider a simple consumption-smoothing model. Assume that we have the following aggregate constraint for the economy:

$$C_t + I_t + B_t = Y_t + (1 + r_t)B_{t-1}$$

where C_t stands for consumption, I_t, investment, Y_t, GDP, B_t, the net foreign assets, and r_t, the interest rate. Re-arranging terms we have that:

$$B_t = Y - C_t - I_t + (1 + r_t)B_{t-1}$$

$$B_t = (1 + r_t)B_{t-1} + NX_t$$

or

$$CA_t = r_t B_{t-1} + NX_t$$

where net exports portion of GDP that is not consumed or invested locally $NX_t = Y - C_t - I_t$; and the current account balance $CA_t = B_t - B_{t-1}$, is the net exports plus the net foreign income.

The previous equation can be re-written as follows:

$$CA_t = Y_t - C_t + r_t B_{t-1} - I_t$$

or

$$CA_t = S_t - I_t$$

where $S_t = Y - C_t - r_t B_t$ is the national saving. In a steady state, the current account is equal to zero because $B_t = B_{t-1} = B$. This is so because countries cannot borrow forever, and therefore, the current account balance should return to the steady state value (and eventually to zero) over time. This implies that a vector that combines saving and investment produces a stationary process (i.e., the current account balance).[9]

For LAC countries, Murthy (2008) found evidence of cointegration between saving and investment rates using a wide battery of first- and second-generation tests. We revisit the results using a larger sample of countries. Our sample includes 24 LAC countries with available

[8] See for example: Ho (2002), Kim, Oh, and Jeong (2005), Bahmani-Oskooee and Chakrabarti (2005), Di Iorio and Fachin (2010), and Kumar and Rao (2011).
[9] Note that dividing all terms by GDP yields the same qualitative result.

(annual) data since 1980 in the World Economic Outlook database.[10] We use the following series: i) "gross capital formation" for domestic investment (at current prices); ii) "gross national savings" for national saving (at current prices); and(iii) Gross Domestic Product (GDP) to compute the ratios of i) and ii) to GDP.

Table 1 presents the summary statistics of investment and saving (over GDP) for each country in the sample:

Table 1: Summary Statistics

	Investment (% of GDP)				Saving (% of GDP)			
	Mean	*S.D*	*min*	*max*	*Mean*	*S.D*	*min*	*max*
Argentina	16.9	2.6	11.6	22.2	16.3	3.4	11.6	24.2
Bahamas, The	24.4	3.5	16.6	30.3	16.1	2.7	10.1	22.4
Barbados	15.6	3.3	7.7	23.4	12.3	3.5	2.3	18.1
Belize	22.4	9.6	12.8	54.7	15.8	8.1	3.1	34.5
Bolivia	15.9	2.8	11.0	23.6	14.3	7.5	2.3	29.0
Brazil	19.8	2.2	16.1	25.0	17.9	2.9	13.0	24.5
Chile	23.0	4.2	12.0	28.8	19.7	6.9	1.5	30.2
Colombia	21.1	3.1	14.1	27.6	17.2	3.0	10.8	20.8
Costa Rica	22.2	3.6	16.0	29.0	17.0	3.0	12.4	23.5
Dominican Republic	27.5	2.8	21.4	32.5	20.4	7.0	7.0	31.0
Ecuador	19.8	4.2	14.1	28.1	18.3	5.5	10.4	29.2
El Salvador	15.2	2.4	11.0	20.0	13.0	3.1	6.9	19.3
Guatemala	16.6	3.3	10.3	20.8	12.2	2.6	6.0	16.0
Honduras	25.6	6.2	15.0	40.7	16.9	5.6	5.4	24.6
Jamaica	22.0	4.4	14.7	28.4	17.8	5.7	6.1	28.3
Mexico	21.4	1.9	16.9	26.9	19.8	2.8	14.0	24.8
Panama	20.7	6.5	2.4	28.6	16.6	4.8	3.8	26.4
Paraguay	19.9	3.9	13.8	28.8	19.1	4.1	12.8	30.6
Peru	20.9	4.3	15.2	32.2	19.2	5.1	10.5	31.0
Trinidad and Tobago	19.9	5.9	11.1	32.9	25.1	10.6	11.1	55.2
Uruguay	16.7	2.9	12.3	23.6	14.0	3.1	8.2	18.9
Venezuela, Rep. Bol.	22.0	5.4	10.2	30.7	27.1	6.8	15.0	41.3
Total	20.4	5.4	2.4	54.7	17.6	6.4	1.5	55.2

The average investment over GDP is 20 percent, and the average saving rate is 17.6 perfect. For the individual country/year observations, the highest investment over GDP value belongs to Belize. The lowest value (2.4 percent) is for Panama in 1990, just after the U.S. invasion. The lowest saving rate on record is 1.5 percent for Chile in 1982, just after the banking

[10] WEO dataset, April 2015 edition.

crisis, and the highest value is 55.2 percent in Trinidad and Tobago in 2006, coinciding with the oil-price boom.

In order to formally test for cointegration between the series of interest in our sample, first we test whether the individual (country) saving and investment series are non-stationary. Specifically, we apply the Augmented Dickey–Fuller and the KPSS (Kwiatkowski et al., 1992) tests. Results are reported in Table 2.[11]

Table 2: Augmented Dickey Fuller (ADF) and KPSS test

	Investment				Saving			
			1st difference				1st difference	
	ADF	*KPSS*	*ADF*	*KPSS*	*ADF*	*KPSS*	*ADF*	*KPSS*
Argentina	-2.62	0.23	-4.23	0.06	-2.08	0.37	-4.81	0.10
Bahamas, The	-2.93	0.14	-4.99	0.04	-3.92	0.10	-6.59	0.03
Barbados	-3.11	0.27	-4.35	0.14	-3.02	0.45	-8.13	0.02
Belize	-2.76	0.13	-5.48	0.04	-2.29	0.28	-6.70	0.05
Bolivia	-2.92	0.11	-5.84	0.04	-2.65	0.36	-5.67	0.04
Brazil	-3.11	0.17	-5.39	0.04	-2.25	0.22	-5.41	0.05
Chile	-2.41	0.47	-6.73	0.11	-2.32	0.43	-6.69	0.06
Colombia	-1.95	0.18	-3.82	0.06	-1.93	0.25	-5.15	0.07
Costa Rica	-3.29	0.33	-7.43	0.03	-2.66	0.21	-6.10	0.07
Dominican Republic	-2.25	0.33	-6.04	0.06	-0.29	0.69	-5.77	0.10
Ecuador	-3.50	0.36	-7.48	0.02	-2.76	0.43	-6.12	0.03
El Salvador	-1.61	0.49	-5.61	0.06	-3.12	0.26	-5.65	0.02
Guatemala	-1.74	0.41	-4.76	0.11	-2.12	0.31	-5.95	0.08
Honduras	-2.69	0.34	-5.86	0.04	-1.64	0.49	-6.26	0.04
Jamaica	-1.93	0.42	-5.49	0.03	-2.46	0.58	-7.41	0.05
Mexico	-4.33	0.40	-6.69	0.09	-2.14	0.55	-7.90	0.42
Panama	-2.43	0.16	-4.37	0.08	-2.94	0.19	-5.80	0.04
Paraguay	-3.47	0.08	-5.52	0.04	-3.36	0.14	-5.54	0.03
Peru	-3.04	0.31	-5.64	0.05	-1.70	0.67	-6.11	0.04
Trinidad and Tobago	-2.80	0.25	-7.11	0.04	-3.09	0.17	-7.06	0.09
Uruguay	-2.37	0.25	-5.26	0.05	-3.84	0.08	-7.31	0.02
Venezuela, Rep. Bol.	-3.88	0.07	-5.82	0.03	-3.11	0.20	-5.86	0.06

Test are run with deterministic trend. The null hypotesis of the ADF is that the variable contains unit root. The critical value at 5% for the ADF test is -3.58 (i.e., the more negative the test result is, the stronger the rejection of the hypothesis that there is a unit root at some level of confidence). Instead, the null hypotesis for the KPSS test is that the series is trend stationary around a deterministic trend. For the KPSS the critical value at 5% is 0.15 (i.e., the larger the test result is, the stronger the rejection of the hypothesis that the series is trend strationary around a deterministic trend)

[11] We excluded Guyana and Haiti from the sample due to unexplained patterns in the data. Guyana's saving rate was highly negative saving during the 1980s, reaching a value of -16 percent of GDP. Haiti's saving rate has a big discontinuous jump in the 1990s, from 5 percent of GDP to 100 percent in only two years. These outliers could bias the results.

The results are that for most countries, the investment and saving series are indeed non-stationary. Furthermore, as shown in Table 2, when we take first differences, we find that the resulting series are mostly stationary, which in turn suggest that investment and saving rates are integrated of order one ($I(1)$).

So far, we have shown that the individual investment and saving series are non-stationary and, moreover, that they are integrated of order one. Next, we employ a different set of tests in order to evaluate the presence of unit root in the panel.[12] The results are reported in Table 3 below:

Table 3: Panel Unit Root tests

		LLC	Harris-Tzavalis	Breitung	Im-Pesaran-Shin	Dickey Fuller	Phillip Perron	Hadri
Investment	t-value	0.36	0.76	-1.13	-0.88	-0.50	-4.01	16.56
	p-value	0.64	0.32	0.13	0.19	0.31	0.00	0.00
Saving	t-value	-0.27	0.81	0.34	0.08	0.41	-2.11	27.90
	p-value	0.39	0.91	0.63	0.54	0.66	0.02	0.00
1rst difference:		LLC	Harris-Tzavalis	Breitung	Im-Pesaran-Shin	Dickey Fuller	Phillip Perron	Hadri
Investment	t-value	-3.74	-0.07	-7.62	-9.06	-9.71	-19.86	-2.94
	p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.99
Saving	t-value	-11.33	-0.15	-9.46	-14.51	-15.40	-22.71	-1.57
	p-value	0.00	0.00	0.00	0.00	0.00	0.00	0.94

LLC is the Levin-Lin-Chu (2002) test, Harris-Tzavalis is the test of Harris and Tzavalis (1999). Breitung is Breitung and Das (2005), Im-Pesara-Shin (2003), and Hadri (2000). In the original series we use 3 lags for each test. In the case of the first differences we use 2 for investment and 1 for saving. For each test, the table reports the test value (t-value) and the corresponding p-value for the rejection of the null-hypothesis.

The table shows that, for most of the tests, the null hypothesis of panel unit root cannot be rejected and that, for the Hadri test in particular, the null hypothesis of stationarity is rejected (the table also shows that in first difference the series are stationary). This suggests that the series (in levels) are not only individually non-stationary, but that in addition, there is evidence of unit root in the panel of LAC countries.

In addition to the Panel Unit Root tests presented, we also include the Pesaran Test allowing for cross-sectional dependence (Pesaran, 2007). This type of test, also known as second generation tests, is useful for macro data, where cross-sectional dependence is usually present.[13] The test results are presented in the Table 4.

[12] We run seven unit root tests: the Levin–Lin–Chu, Harris–Tzavalis, Breitung, Im–Pesaran–Shin, Dickey–Fuller, and Phillips–Perron unit root tests, whose null hypothesis is that all panels are stationary, and the Hadri unit root test, whose null hypothesis is that all panels are stationary.

[13] Cross-sectional dependence can be generated due to spatial effects or by omitted variables.

Table 4: Pesaran Test Results for the Presence of Cross-sectional Dependence

	Test-Value	Critical Value (10%)	Critical Value (5%)
Investment	-1.68	-2.04	-2.11
Saving	-1.69	-2.04	-2.11
1rst Difference Investment	-2.68	-2.07	-2.15
1rst Difference Saving	-2.59	-2.07	-2.15

Each estimation is made with 3 lags. The null hypotesis is that the series is non-stationary. The critical values at 10% and 5% confidence levels are provided in the table. Given that the critical values are negative, the more negative the test result is, the stronger the rejection of the hypothesis that the series is non-stationary

Table 4 shows that we cannot reject the null hypothesis that the series are non-stationary. Instead, when we test the first difference of both series, we find that we reject the null hypothesis of non-stationarity, i.e., the series are *I*(1). The results thus indicate that in this sample, there is no statistically discernible presence of cross-sectional dependence. Therefore, further analysis of this problem has not been pursued in the paper

Finally, we test whether the series are cointegrated in panel. For this, we employ the Pedroni (1999) tests. These tests state the null hypothesis of non-cointegration. Pedroni (1999) developed seven tests for "within" (Panel) and "between" (Group) panel integration. The tests are standardized, and the coefficients reported below have a normal (0,1) distribution. We are particularly interested in the between tests, because we subsequently use a between estimator. This estimator is considered the continuation of Engle and Granger (1987) and it permits obtaining the critical values of the tests in Pedroni (1995, 1997). The results are reported in Table 5 below.

Table 5: Pedroni's test of panel cointegration

Test	Test-Value[1]
Panel v statistic	0.3651
Panel rho statistic	1.4747*
panel t statistic (non parametric)	3.2004***
Panel t statistic (parametric)	7.8037***
Group rho statistic	8.2752***
Group t statistic (non parametric)	5.0375***
Group t statistic (parametric)	5.2288***

For all the tests, the null hypothesis is of no-cointegration in panel. Significance level*<10%, **<5%, ***<1%

[1]the test has a normal distribution, time FE is included.

Note that six of the seven tests reject the null hypothesis of no-cointegration in panel. In particular, all the group tests reject the null-hypothesis. This suggests that there is evidence that the series are cointegrated in panel.

We conclude that there is evidence that the national saving and investment series are cointegrated in panel. Therefore, we propose using the FMOLS approach to estimate the long-run relationship between these series of interest. In particular, given the panel structure of the dataset, in the preferred specification we employ Pedroni's GM-FMOLS estimator. For comparability, we will also show the results using the pooled OLS panel, and the fixed-effects estimators.

3. Regression Results

Table 6 reports the aggregate results of equation (1) using the panel group estimator (i.e., Pedroni's GM-FMOLS estimator), the Pooled OLS estimator, and the panel fixed-effects estimator. In the three cases, the results are reported with and without time dummies.

Table 6: Feldstein and Horioka-type estimates for LAC (panel regressions)

	FMOLS	OLS	Panel FE
Panel Group	0.3948***	0.3759***	0.3432***
Panel Group with time dummy	0.3840***	0.3695***	0.3300***

Table reports the coefficient estimate β in equation (1). Significance level*<10%, **<5%, ***<1%

The panel group coefficient estimate β for LAC is equal to 0.39; this is marginally larger than the corresponding pooled OLS estimator (0.37), and also larger than the panel fixed effect estimate (0.34). Taking these results at face value, they imply that in the LAC region, for every 1 percentage point increase in national saving, domestic investment increases by 0.39 percentage points, on average. While this is significantly lower than the original Feldstein and Horioka (1980) estimate for OECD countries (i.e., 0.89); it is still suggestive of a high level of saving retention in the LAC region.

In order to evaluate appropriateness of the selected empirical approach, we test if the errors of the regression are stationary. To do so, as suggested Kapetanios, Pesaran and Yamagata (2011), we apply the Pesaran (2007) test. The results are presented in the Table 7. Reassuringly, the test results reject the hypothesis of non-stationary residuals.

Table 7: Pesaran (2007) Panel Unit Root Test applied to model's residuals

	Value	Critical Value (10%)	Critical Value (5%)
Panel Group	-2.43	-2.07	-2.15
Panel Group with time dummy	-2.39	-2.07	-2.15

The null hypothesis is that the regression residuals are non-stationary. The table eports the test value and the critical values at different levels of significance. Given that the critical values are negative, the more negative the test result is, the stronger the rejection of the null hypothesis.

4. Saving Retention in LAC and the Rest of the World

How do the results obtained for LAC compare to other regions? We compute the panel group coefficient for the other regions using data from the WEO database. We divide the world into six groups: LAC; Advanced Economies, Eastern Europe,[14] Developing Asia, the Middle East, North Africa, and Pakistan (MENA), and Sub-Saharan Africa (SSA). The countries included in each group—other than LAC, which was defined above—are listed in Table 8.

Table 8: Country list by World Bank's classification

Advanced Economies		Eastern Europe	Developing Asia	MENA	Sub-Saharan Africa	
Australia	Luxembourg	Albania	Bangladesh	Algeria	Angola	Lesotho
Austria	Netherlands	Armenia	Bhutan	Bahrain, Kingdom of	Benin	Madagascar
Belgium	New Zealand	Belarus	Cambodia	Egypt	Botswana	Malawi
Canada	Norway	Bulgaria	China,P.R.: Mainland	Iran, I.R. of	Burkina Faso	Mali
China,P.R.:Hong Kong	Portugal	Croatia	India	Jordan	Burundi	Mauritius
Cyprus	Singapore	Czech Republic	Indonesia	Lebanon	Cameroon	Mozambique
Denmark	Spain	Estonia	Malaysia	Libya	Central African Rep.	Niger
Finland	Sweden	Hungary	Nepal	Morocco	Comoros	Nigeria
France	Taiwan Prov.of China	Latvia	Philippines	Oman	Congo, Republic of	Rwanda
Germany	United Kingdom	Lithuania	Sri Lanka	Pakistan	Côte d'Ivoire	Senegal
Greece	United States	Moldova	Thailand	Qatar	Ethiopia	Sierra Leone
Iceland		Poland	Vietnam	Saudi Arabia	Gabon	South Africa
Ireland		Romania		Syrian Arab Republic	Gambia, The	Swaziland
Israel		Russian Federation		Tunisia	Ghana	Tanzania
Italy		Slovak Republic		Turkey	Guinea	Togo
Japan		Slovenia		United Arab Emirates	Guinea-Bissau	Uganda
Korea, Republic of		Ukraine			Kenya	Zambia

Therefore, by region we estimate equation (1) using the GM- FMOLS estimator. The results (with and without time fixed effects) are reported in Table 9 below.

[14] Data for these countries are available beginning in the 1990s.

Table 9: Feldstein and Horioka-type estimates for world regions (panel regressions)

	Beta without time dummy	Beta with time dummy
LAC	0.39***	0.38***
Advanced Economies	0.34***	0.34***
Eastern Europe	0.60***	0.55***
Developing Asia	0.60***	0.76***
MENA	0.31***	0.31***
Sub Saharan Africa	0.51***	0.51***
World (Pooled)	0.47***	0.47***

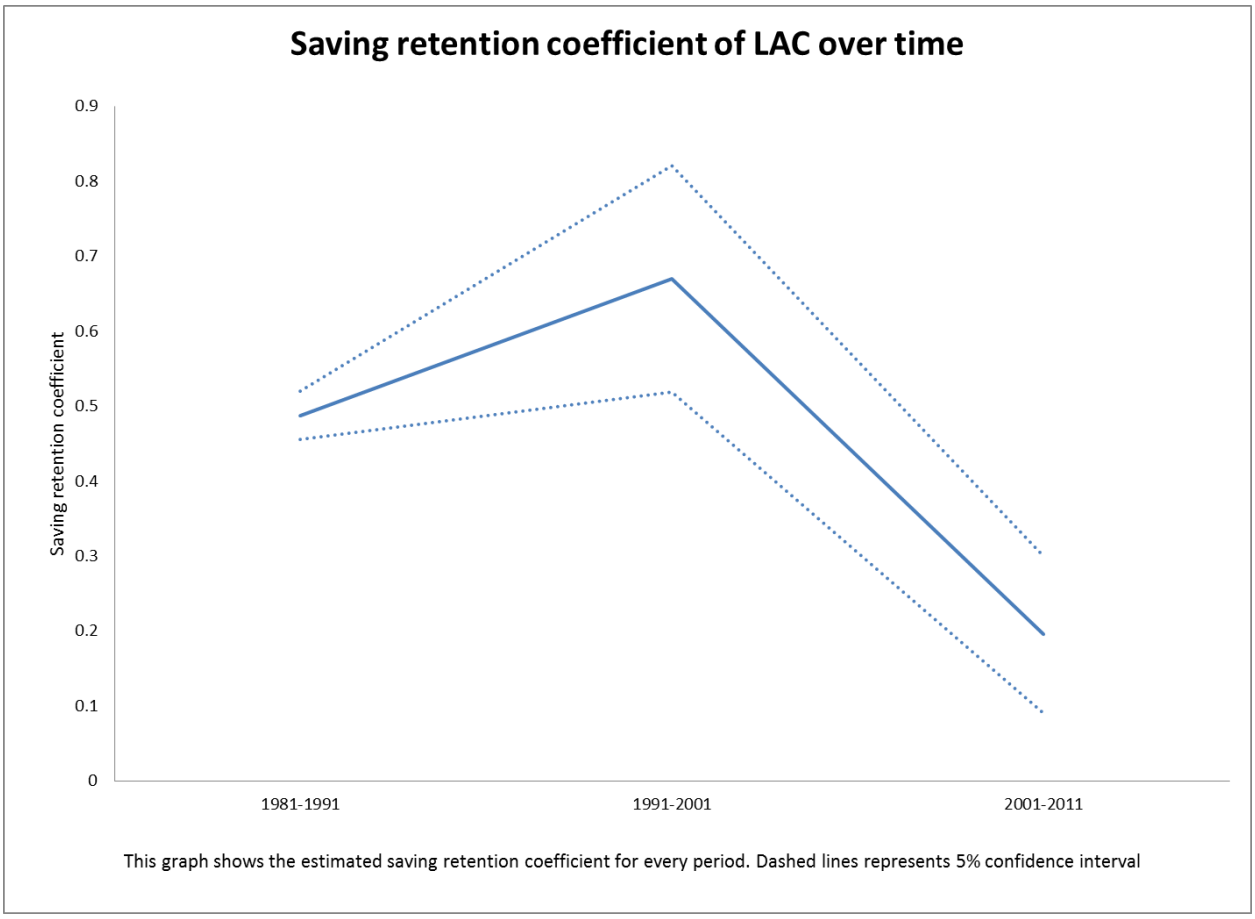
Table reports the coefficient estimate β in equation (1).
Significance level*<10%, **<5%, ***<1%

The estimated saving retention coefficient in LAC is similar to the value found for advanced economies. This suggests that the estimated long-run relationship between the variables of interest is not sensitive to differences in income levels. Moreover, LAC's estimated saving retention is significantly lower than in Eastern Europe and Developing Asia, but higher than in the MENA region. For the entire world, the estimated correlation coefficient is 0.47.

5. Saving Retention in LAC Over Time

How has the estimated saving retention in LAC changed over time? In order to answer this question we estimate the panel group coefficient for the LAC region using non-overlapping decades: i.e., i) the 1980s, ii) the 1990s, and iii) the 2000s. The estimated coefficients (and standard errors) by decade are reported in Figure 1.

Figure 1.

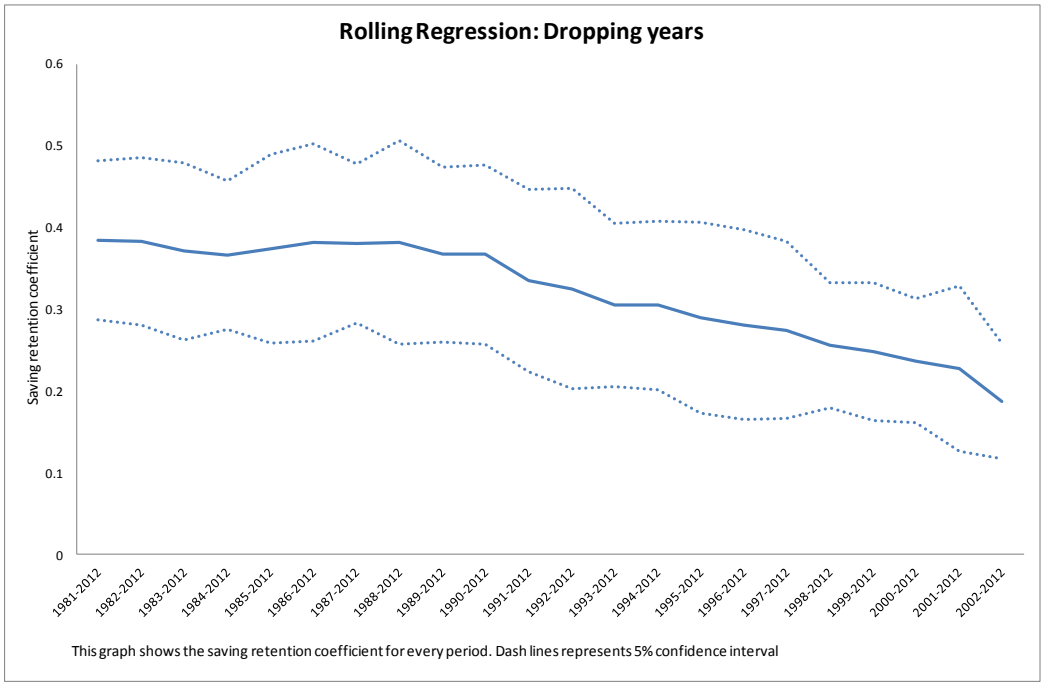


The estimated coefficient was relatively high in the 1980s (0.49), the period known as the "Lost Decade" in LAC for its dismal economic performance in the aftermath of the debt crises. In the 1990s, during the "reform period," the estimated correlation increased to 0.67. Finally, the coefficient estimate fell to 0.20 in the most recent period.

The increase in the estimated coefficient during the 1990s is somewhat surprising because this was a period when most countries in the region began opening up their trade and capital accounts, thereby increasing de jure financial integration with the rest of the world. If the positive link between national saving and investment is due to imperfect capital mobility, then we would expect a lower saving retention coefficient in LAC during the (relatively open) 1990s vis-à-vis the (relatively closed) 1980s. However, the puzzling increase in the 1990s seems to be idiosyncratic to the choice of estimating the relationship using non-overlapping decades.

To probe this question more deeply, we re-estimate the relationship between saving and investment using a different sampling strategy: rather than using non-overlapping decades, we compute a rolling regression whereby we sequentially drop years from the sample. Therefore, in Figure 2, the first observation represents the panel estimate for the full LAC sample over the entire period (1980 – 2012). Note that this is the same as the panel group estimate reported in Table 6. Next, the figure shows the estimate corresponding to the period (1981 – 2012), then (1982-2012), etc., up to the last point estimate that corresponds to the period (2002-2012). In this case the panel group estimates show a more nuanced picture. As shown, the estimated saving retention coefficients are high and flat while the years of the 1980s remain in the sample. Then, beginning after the year 1988, there is a monotonic decrease in the panel group estimates up to the low estimate for the end of the sample, which comprises the last decade only.

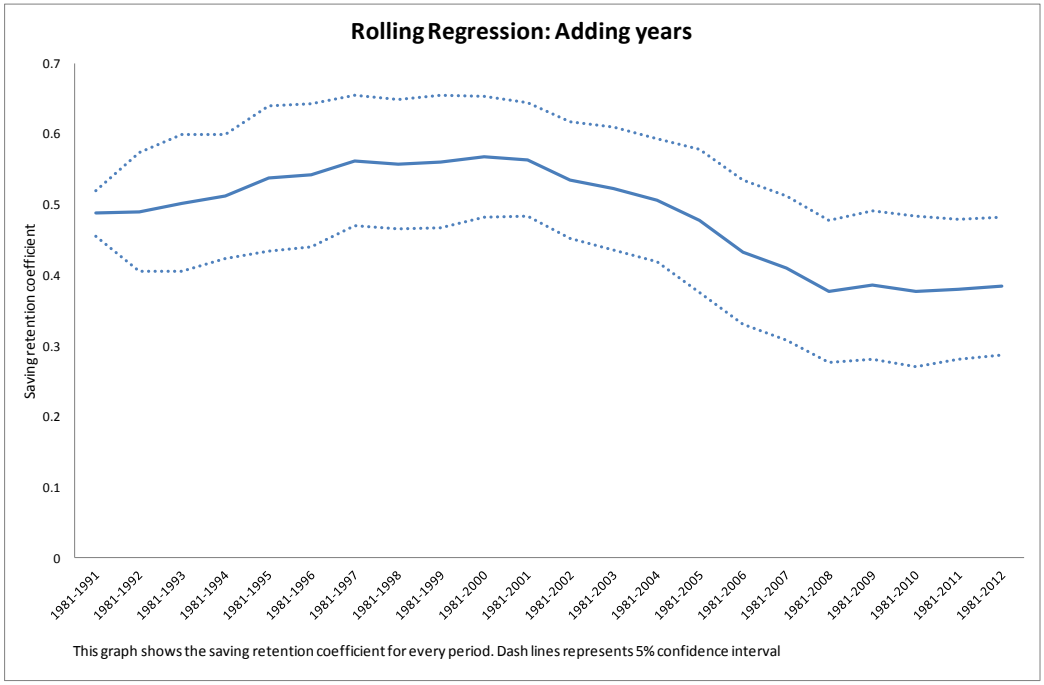
Figure 2.



A similar picture is obtained if, instead of fixing the end date in the sample, we fix the starting date (1980) and subsequently add annual observations. The result is shown in Figure 3. The initial estimates of the saving retention coefficient are approximately 0.49 until, beginning with the inclusion of the years in the late 1990s, the coefficient estimates gradually drop. Interestingly, the inclusion of the post-global crisis years (2009 onward) does not change the

results. This suggests that after the global financial crisis, there has been no further increase in de facto financial integration in the region.

Figure 3.



The bottom line is that the aggregate panel group estimate of the saving retention coefficient for LAC hides significant variation over time. In recent years—at least up to the beginning of the global financial crisis in 2008—the saving retention coefficient appears to have dropped.

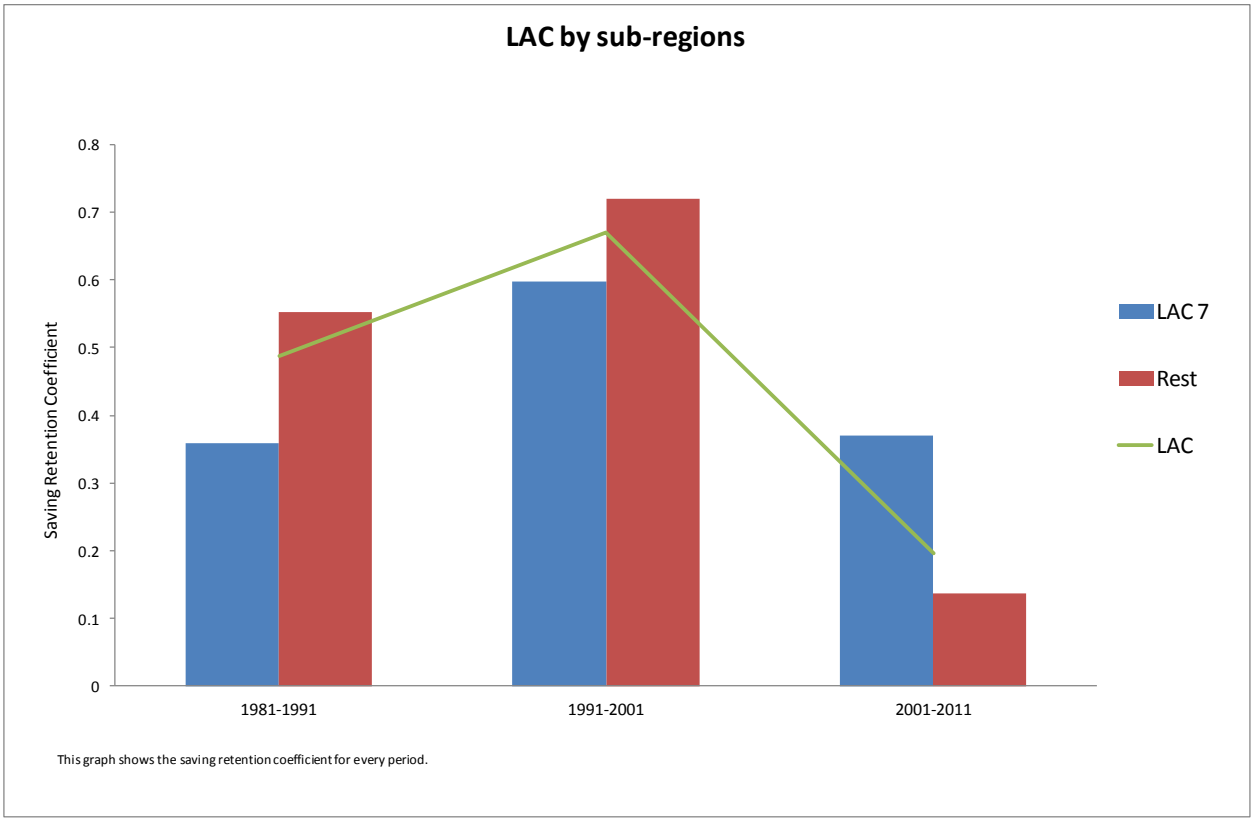
6. Saving Retention within the LAC Region

In this section, we explore the heterogeneity in results within the LAC region. For this, we divide the sample of countries in the LAC region into two groups (in the Appendix we include estimations for additional splits):

- LAC 7: Argentina, Brazil, Chile, Colombia, Mexico, Peru and Venezuela.
- Other LAC: Bahamas, Barbados, Belize, Bolivia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Panama, Paraguay and Trinidad and Tobago.

LAC-7 comprises the set of largest economies in the region; which together account for more than 90 percent of regional GDP. Before proceeding, it is worth emphasizing that there is a tradeoff in estimating β in equation (1) using smaller samples. This is so because the asymptotic convergence of the estimated β to the true coefficient is valid when N is large (Pedroni, 1997). Therefore, the smaller is N, the smaller is the probability that the asymptotic convergence holds. This caveat notwithstanding, in order to explore the possible heterogeneity within LAC we estimate equation (1) using the GM-FMOLS for each group, over 10-year (non-overlapping) periods. The results are reported in Figure 4.

Figure 4.



The green line in Figure 4 is the panel group estimate of β for the region (i.e., the same as in the preceding sections). The bars in the chart are the subregional estimates over the different decades. Interestingly, Figure 4 shows that there are different behaviors among the two groups. In particular, LAC7 exhibits smoother dynamics. The fall in the estimated saving retention

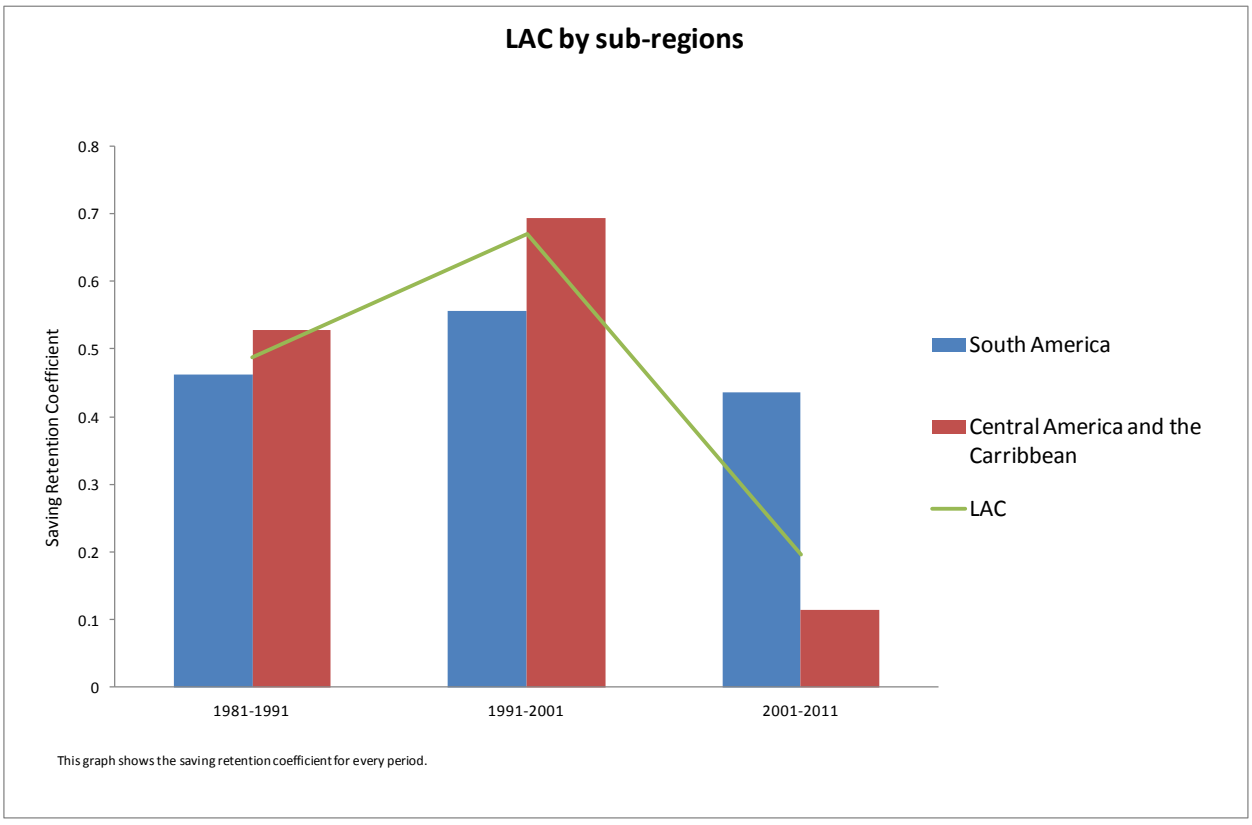
coefficient in LAC that is observed over the last decade is driven more by the decline observed in the group of smaller countries in the region.

As a variant of the preceding approach, we group countries along geographical lines:

- Central America and the Caribbean: Bahamas, Barbados, Belize, Costa Rica, Dominican Republic, El Salvador, Guatemala, Honduras, Jamaica, Mexico, Panama and Trinidad and Tobago
- South America: Argentina, Bolivia, Brazil, Chile, Colombia, Ecuador, Paraguay, Peru, Uruguay and Venezuela

The results are presented in the Figure 5.

Figure 5.



As in Figure 4, the green line is the panel group estimator for the whole region and the bars in the chart are the subregional estimates over the different decades. Figure 5 shows that the panel estimate in the region seems to be driven by Central America and the Caribbean. Instead, the South America group exhibits a less pronounced fall in the 2000s. This result is consistent

with additional estimates of sample splits reported in the Appendix; they all confirm that the estimate of β that comes from the regional sample hides a significant degree of intra-regional heterogeneity.

7. Conclusion

Since the late 1980s, many countries in the LAC region have sought to increase financial integration, opening up the trade and financial accounts of the balance of payments. In this paper, we explore whether this process has resulted in a lower correlation between national saving rates and domestic investment in the region.

In particular, we estimated the correlation coefficient between national saving and domestic investment in the Latin American and Caribbean region. Using Pedroni's cointergration methods for panel regressions, we obtained unbiased and consistent estimates of the long-run relationship between the two series of interest.

The results are novel on several fronts. First, we found evidence of heterogeneity in the estimated correlations across countries in LAC. While the aggregate (average) correlation coefficient in LAC is 0.39, there is variance across sub groups in LAC, with larger countries in the region exhibiting higher estimated correlations and lower variation over time in the coefficient estimate.

Second, the estimated correlation coefficient between national saving and domestic investment in LAC has been declining over time, particularly up to the global financial crisis in 2008. This fall suggests that financial integration has effectively increased in the region over the last two decades up to the crisis. Nonetheless, the fact that the estimated correlation remains positive and significant, suggests that integration is still imperfect, and therefore low national saving rates remain a binding constraint on investment and growth in LAC.

Going back to the question we posed in the introduction: can an investment push in LAC be financed by foreign saving only? That is, were good investment opportunities to emerge due to, for example, an increase in productivity, would foreign saving flow in to tap the emerging opportunities? If so, (low) national saving would not be a binding constraint. From an empirical standpoint, our results suggest that the answer is a clear-cut "No."[15] In the data, national saving

[15] However, a definitive answer to this question is dependent on specific country circumstances, including the ease of access to external finance, the country's creditworthiness, and the external financial cycle itself.

and domestic investment are positively correlated. Moreover, while the correlation has been declining in the region over the last two decades in the presence of efforts to increase financial integration, our results show that it remains positive and significant.

Our results however, do not say anything about the direction of causality between investment and national saving. There is still a largely unresolved debate in the literature as to whether saving precedes investment, or the other way around. The first view is that Latin America and the Caribbean's low national saving rates are primarily the consequence of the region's history of low economic growth and stagnant productivity.[16] In this view, the region's history of economic and political instability has translated over time into poor investment opportunities and therefore generated disincentives to save. To reverse this cycle, policymakers would be well advised to focus on policy interventions that promote growth. If investment opportunities appear, saving would quickly follow. The alternative position has traditionally stressed the causal link from saving to growth via capital accumulation.[17] To grow, countries need to invest in physical capital; this investment in turn requires saving. Therefore, policymakers would be well advised to focus on policy interventions to promote saving. If national saving appears, investment and growth would quickly follow.

The details of the debate mask the inescapable fact that, as argued by the Commission on Growth and Development (2008), the causation probably runs in both directions. What our results highlight, however, is that given the positive correlation between domestic investment and national saving rates, policies to promote national saving and policies that promote investment should be consistent. If pro-savings polices have the unintended consequence of discouraging investment, then those policies are likely to fail. This is far from a merely abstract debate: some popular pro-savings policies, such as providing incentives for saving locally via tax breaks, or creating mandatory saving vehicles, have backfired when the overall consistency of policies was not taken into account in policy design.[18] With sound and stable policy frameworks, LAC would likely achieve both higher investment and higher national saving as part of the same equilibrium. Without them, economic agents remain likely to find ways to protect the real value of saving—for example, via capital flight—and low national saving will remain a binding constraint on investment and long-term growth.

[16] See Gavin, Hausmann and Talvi (1997).
[17] See Mankiw, Romer and Weil (1992).
[18] See Reinhardt (2008) and Grigoli, Herman and Schmidt-Hebbel (2015) for a review of the literature.

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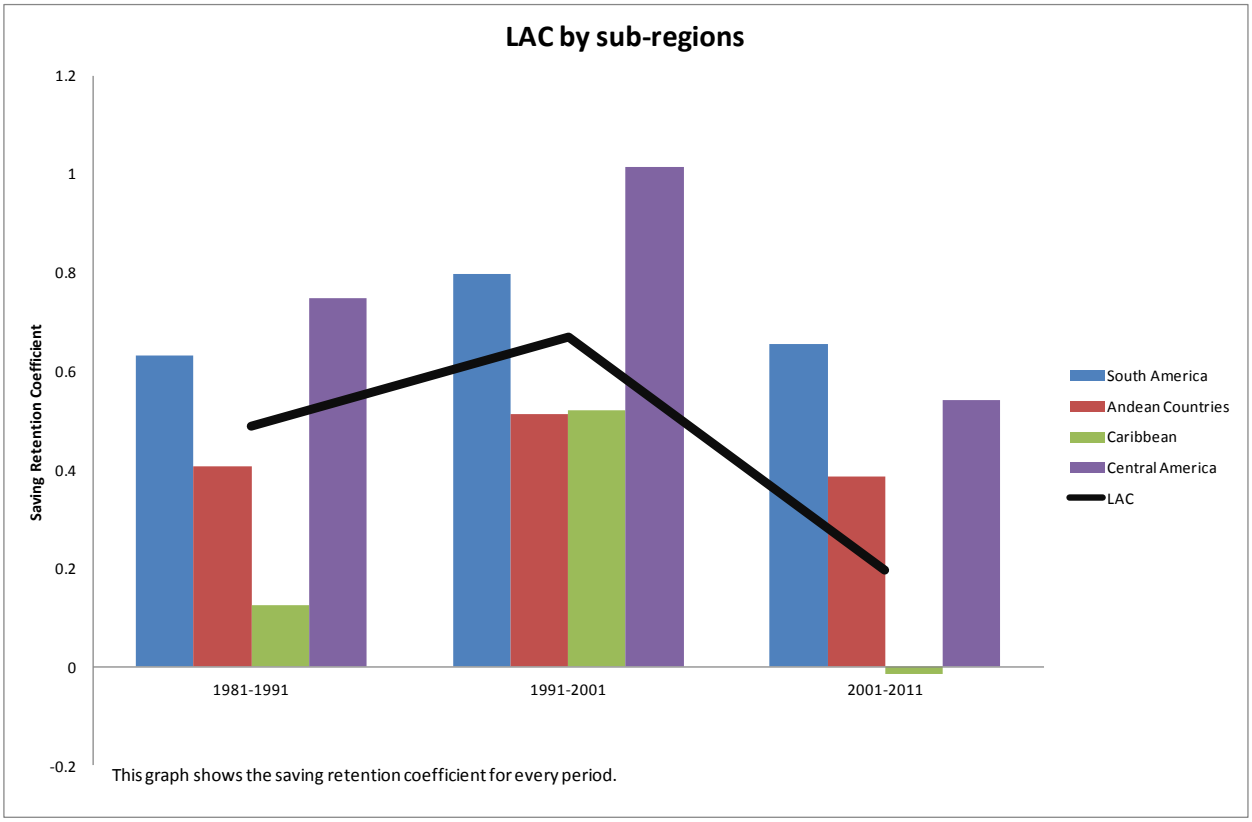
Appendix

We estimate equation (1) using GM-FOLS for four different subregions:

1. Andean Countries: Bolivia, Colombia, Ecuador, Peru, and Venezuela
2. Caribbean Countries: Bahamas, Barbados, Dominican Republic, Jamaica, and Trinidad and Tobago
3. Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, and Panama
4. South America: Argentina, Brazil, Chile, Paraguay, and Uruguay

We compute the panel regressions for each group, for the different decades and obtain the results shown in Figure A1.

Figure A1.



The black line in Figure A1 is the panel group estimator for the region (i.e., the same as in the preceding sections). The bars in the chart are the sub regional estimates over the different

decades. Interestingly, Figure A1 shows that there are divergent behaviors among the four groups. In all groups, the estimated saving retention coefficient fell over the last decade; the largest decline in absolute terms was amongst the Caribbean countries (where the coefficient estimate for the last decade was negative) and Central America (albeit in this case, the coefficient estimate fell from very high levels in the preceding decade). The coefficient estimates were relatively more stable amongst the Andean group, and for this group, the dynamics trace those of the regional (aggregate) average. Finally, in the Southern Cone countries, the estimated correlation has remained relatively high throughout the estimation period.