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The Relationship between National Saving and Investment in Latin America and the Caribbean

ABSTRACT Using panel cointegration techniques and a comprehensive data set 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. The estimated correlation is approximately 0.39; that is, for every one 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 intraregional heterogeneity; and (iii) the estimated coefficient is largest among the biggest economies in the region. Low national saving rates remain a binding constraint for capital accumulation in Latin America and the Caribbean.

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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, or from external sources, via the absorption of foreign saving (that is, net capital inflows). In Latin America and the Caribbean, 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 Latin America and the Caribbean invest less than 20 percent of gross domestic product (GDP) per year on average,

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1. According to data from the World Economic Outlook database, over the last thirty years, national saving rates in Latin America and the Caribbean have been practically stagnant at approximately 20 percent of GDP, while in emerging Asia saving rates increased by 6.5 percentage points, to 35 percent of GDP, in the same period.

countries in emerging Asia invest close to 30 percent on average.[2] According to the Commission on Growth and Development, overall investment rates of 25 percent of GDP or higher are needed to back up strong economic growth.[3] Low investment rates in Latin America and the Caribbean are therefore a binding constraint on growth.

From a policy standpoint, a relevant question is whether countries in Latin America and the Caribbean can increase investment rates without increasing national saving. The only way to do so would be to increase the absorption of foreign saving.[4] Over the last three decades, many countries in the 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 the extent to which these efforts have changed the estimated relationship between national saving and domestic investment in the region.

In an influential early paper, Feldstein and Horioka set forth one of the major puzzles in open economy macroeconomics.[5] They find a positive and significant correlation between national saving and domestic investment rates in a cross-section of thirteen member countries of the Organization for Economic Cooperation and Development (OECD). Their correlation coefficient is close to one, suggesting that for every one-percentage-point increase in national saving (as a percentage of GDP), domestic investment increases by the same amount, meaning almost full "saving retention" within these economies. This constitutes a puzzle because in open economies, if 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.[6] The counterfactual empirical result reveals that effective financial integration across OECD countries is lower than previously thought.

Since the initial contribution, numerous studies have reestimated the relationship in various forms. Some authors expand the original sample of countries

2. The variable used in national accounts to measure investment is gross fixed capital formation (GFKF), which is a component of GDP. It includes physical capital investment (that is, machinery, plants, infrastructure, and so forth) plus investments in commercial and residential dwellings.

3. Commission on Growth and Development (2008).

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

5. Feldstein and Horioka (1980); Obstfeld and Rogoff (2001).

6. Feldstein and Bacchetta (1991).

to include developing countries; other studies estimate the relationship using different time periods; and some authors estimate the relationship using time series rather than purely cross-sectional analysis.[7] While the original results showing a high 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 in dispute. Among the competing explanations, Martin Feldstein and coauthors emphasize the role of imperfect capital mobility across countries: the 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.[8]

There are two main criticisms of the Feldstein-Horioka 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 purely cross-sectional analysis. This has compelled many authors to reestimate the relationship between national saving and investment, exploiting time-series variation as well as cross-country variation in the data using panel data sets, since panel data estimation techniques provide a way to account for unobservable heterogeneity across countries. The second criticism, however, is 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 nonstationary, leading to problems of cointegration in the panel.[9] Moreover, as Feldstein and Horioka emphasize, the close relationship between national saving and domestic investment is a long-term characteristic and may not hold from year to year.[10] This implies that when annual panel data are used, the simple correlation between the series is likely to be much lower than in cross-sectional analyses. It is therefore necessary to employ techniques

7. For literature surveys, see Tesar (1991); Coakley, Kulasi, and Smith (1998); Apergis and Tsoumas (2009).

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

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

10. Feldstein and Horioka (1980).

that allow searching for the long-term relationship between the variables in time series.

To address these problems, we estimate the Feldstein-Horioka coefficient for the Latin American and Caribbean countries using Pedroni's panel cointegration techniques.[11] This methodology allows us to find the long-term relationship between the series of interest in the presence of the estimation challenges posed by cointegration in panel data. By applying this methodology, we can estimate how the relationship between national saving and investment has changed over time and also compare the estimated coefficients across subregions in Latin America and the Caribbean. 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 Latin America and the Caribbean employing the most comprehensive data available for the relevant series.

Murthy estimates the Feldstein-Horioka coefficient for the Latin American and Caribbean region using a similar approach but a different sample.[12] He obtains an estimated correlation coefficient of approximately 0.50. This is slightly higher than our baseline estimation (0.39); the difference probably derives from the different samples used. 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 subregions within Latin America and the Caribbean, as well as across individual countries in the region. Moreover, we compare the coefficient estimate for Latin America and the Caribbean to other regions in the world.

We find that the estimated correlation between national saving and investment in the region is approximately 0.39; that is, for every one-percentage-point increase in national saving, domestic investment increases by 0.39 percentage point, on average. There are, however, three nuances to the headline result: (i) for the whole region, the estimated correlation has declined 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 intraregional heterogeneity, with a higher correlation coefficient estimated for larger economies;[13] and (iii) the declining regional

11. Pedroni (1999, 2000, 2001, 2004).

12. Murthy (2008).

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

average is largely driven 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 Latin America and the Caribbean remains imperfect and incomplete. Therefore, mobilizing national saving remains a key policy challenge to support capital accumulation in the region.

Methodology and Data

The starting point in the analysis is the basic equation that was estimated by Feldstein and Horioka.[14] Consider the following variant of the equation:

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

where $I_{i,t}$ is the investment of country i in year t, $Y_{i,t}$ is GDP, $S_{i,t}$ is national savings, $\varepsilon_{i,t}$ 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 take 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 equation 1 in a panel.

The term of interest is β. This variable is 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 equation 1 using Pedroni's group-mean fully modified ordinary least squares (GM-FMOLS) panel method.[15] This methodology permits estimating the relationship taking into account that the underlying series may be first-order integrated, or $I(1)$, and cointegrated in the panel. Two time series are cointegrated if they are individually nonstationary, for example $I(1)$, but there is a (cointegrating) vector in common that forms a stationary linear combination of the two.

14. Feldstein-Horioka (1980).
15. Pedroni (1999, 2000).

Some previous studies, using different samples, provide evidence that national saving and investment series are nonstationary and cointegrated.[16] This is not surprising since the difference between the two series is the current account balance, which is a time series that is usually stationary (that is, countries cannot become further indebted forever).

To show this, we use 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, net foreign assets, and r_t, the interest rate. Rearranging terms yields

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

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

or

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

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

The previous equation can be rewritten 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 national savings. 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 thus 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 (that is, the current account balance).[17]

16. See, for example, Ho (2002); Kim, Oh, and Jeong (2005); Bahmani-Oskooee and Chakrabarti (2005); Di Iorio and Fachin (2010); Kumar and Rao (2011).

17. Dividing all terms by GDP yields the same qualitative result.

TABLE 1. Summary Statistics

	Investment (% of GDP)				*Saving (% of GDP)*			
Country	*Mean*	*Std. deviation*	*Minimum*	*Maximum*	*Mean*	*Std. deviation*	*Minimum*	*Maximum*
Argentina	16.9	2.6	11.6	22.2	16.3	3.4	11.6	24.2
Bahamas	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	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

For Latin American and Caribbean countries, Murthy finds evidence of cointegration between saving and investment rates using a wide battery of first- and second-generation tests.[18] We revisit the results using a larger sample of countries. Our sample includes twenty-four Latin American and Caribbean countries with available (annual) data since 1980 in the World Economic Outlook (WEO) database.[19] 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. The average investment over GDP is

18. Murthy (2008).
19. International Monetary Fund, World Economic Outlook (WEO) database, April 2015.

20 percent, and the average saving rate is 17.6 percent. For the individual country/year observations, the highest investment over GDP value is recorded by 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 crisis, and the highest value is 55.2 percent in Trinidad and Tobago in 2006, coinciding with the oil-price boom.

To formally test for cointegration between the series of interest in our sample, we first test whether the individual (country) saving and investment series are nonstationary. Specifically, we apply the augmented Dickey-Fuller (ADF) and the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) tests.[20] Results are reported in table 2.[21] For most countries, the investment and saving series are indeed nonstationary. Furthermore, when we take first differences, we find that the resulting series are mostly stationary, which in turn suggests that investment and saving rates are integrated of order one, or $I(1)$.

So far, we have shown that the individual investment and saving series are nonstationary and that they are integrated of order one. Next, we employ a different set of tests to evaluate the presence of a unit root in the panel.[22] The results are reported in table 3. For most of the tests, the null hypothesis of a panel unit root cannot be rejected, and for the Hadri test in particular, the null hypothesis of stationarity is rejected. (The table also shows that the series are stationary in first differences.) This suggests not only that the series (in levels) are individually nonstationary, but that there is evidence of a unit root in the panel of Latin American and Caribbean countries.

In addition to the panel unit root tests presented, we include the Pesaran test allowing for cross-sectional dependence.[23] This type of test, also known as a second-generation test, is useful for macroeconomic data, where cross-sectional dependence is usually present.[24] The test results are presented in table 4. As the table shows, we cannot reject the null hypothesis that the series are nonstationary. Instead, when we test the first difference of both series, we find that we reject the null hypothesis of nonstationarity, that is, the series

20. Kwiatkowski and others (1992).

21. We excluded Guyana and Haiti from the sample due to unexplained patterns in the data. Guyana's saving rate was highly negative in 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.

22. 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.

23. Pesaran (2007).

24. Cross-sectional dependence can be generated by spatial effects or omitted variables.

TABLE 2. ADF and KPSS Tests[a]

	Investment				*Saving*			
			First difference				*First difference*	
Country	*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	−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	−3.88	0.07	−5.82	0.03	−3.11	0.20	−5.86	0.06

a. Test are run with a deterministic trend. The null hypothesis of the augmented Dickey-Fuller (ADF) test is that the variable contains a unit root. The critical value at 5 percent for the ADF test is −3.58 (that is, the more negative the test result, the stronger the rejection of the hypothesis that there is a unit root at some level of confidence). The null hypothesis for the Kwiatkowski-Phillips-Schmidt-Shin (KPSS) test is that the series is trend stationary around a deterministic trend. For the KPSS, the critical value at 5 percent is 0.15 (that is, the larger the test result, the stronger the rejection of the hypothesis that the series is trend stationary around a deterministic trend).

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 is not pursued in this paper.

Finally, we test whether the series are cointegrated in the panel using the Pedroni tests, which state the null hypothesis of non-cointegration.[25] Pedroni developed seven tests for within (panel) and between (group) panel integration. The tests are standardized, and the coefficients have a normal (0,1) distribution (see table 5). We are particularly interested in the between tests, because we subsequently use a between estimator, which is a continuation of Engle and

25. Pedroni (1999).

TABLE 3. Panel Unit Root Tests[a]

Series	*Levin-Lin-Chu*	*Harris-Tzavalis*	*Breitung*	*Im-Pesaran-Shin*	*Dickey-Fuller*	*Phillips-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
First difference							
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

a. The tests are from Levin, Lin, and Chu (2002), Harris and Tzavalis (1999), Breitung (2000), Breitung and Das (2005), Im, Pesaran, and Shin (2003), Phillips and Perron (1988), and Hadri (2000). In the original series, we use three lags for each test; in the case of the first differences, we use two lags for investment and one lag 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.

TABLE 4. Pesaran Test Results for the Presence of Cross–Sectional Dependence[a]

Series	*Test value*	*Critical value (10%)*	*Critical value (5%)*
Investment	−1.68	−2.04	−2.11
Saving	−1.69	−2.04	−2.11
First difference			
Investment	−2.68	−2.07	−2.15
Saving	−2.59	−2.07	−2.15

a. Each estimation is made with three lags. The null hypothesis is that the series is nonstationary. The critical values at 10 percent and 5 percent confidence levels are provided in the table. Given that the critical values are negative, the more negative the test result, the stronger the rejection of the hypothesis that the series is nonstationary.

TABLE 5. Pedroni Test of Panel Cointegration[a]

Test	*Test value*
Panel v statistic	0.3651
Panel rho statistic	1.4747*
Panel *t* statistic (nonparametric)	3.2004***
Panel *t* statistic (parametric)	7.8037***
Group rho statistic	8.2752***
Group *t* statistic (nonparametric)	5.0375***
Group *t* statistic (parametric)	5.2288***

*Statistically significant at the 10 percent level.
***Statistically significant at the 1 percent level.
a. For all the tests, the null hypothesis is non-cointegration in the panel. The test has a normal distribution; time fixed effects are included.

TABLE 6. Feldstein-Horioka-Type Estimates for Latin America and the Caribbean: Panel Regressions[a]

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

***Statistically significant at the 1 percent level.
a. The table reports the coefficient estimate β in equation 1.

Granger and allows us to obtain the critical values of the Pedroni tests.[26] As shown in table 5, six of the seven tests reject the null hypothesis of non-cointegration in the panel. In particular, all the group tests reject the null hypothesis. This suggests that there is evidence that the series are cointegrated in the panel.

We conclude that there is evidence that the national saving and investment series are cointegrated in the panel. We therefore propose using the FMOLS approach to estimate the long-run relationship between the series of interest. Given the panel structure of the data set, our preferred specification employs Pedroni's GM-FMOLS estimator. For comparability, we also show the results using the pooled OLS panel and the fixed-effects estimators.

Regression Results

Table 6 reports the aggregate results of equation 1 using the panel group estimator (that is, Pedroni's GM-FMOLS estimator), the pooled OLS estimator, and the panel fixed-effects estimator. In all three cases, the results are reported with and without time dummy variables. The panel group coefficient estimate, β, for Latin America and the Caribbean is 0.39; this is marginally larger than the corresponding pooled OLS estimate (0.37) and also larger than the panel fixed-effects estimate (0.34). At face value, these results imply that in Latin America and the Caribbean region, for every one-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-Horioka estimate for OECD countries (namely, 0.89), it is still suggestive of a high level of saving retention in the Latin American and Caribbean region.[27]

26. Engle and Granger (1987); Pedroni (1995, 1997).
27. Feldstein and Horioka (1980).

TABLE 7. Pesaran Panel Unit Root Test Applied to the Model Residuals[a]

Estimate	*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

a. The unit root test is from Pesaran (2007). The null hypothesis is that the regression residuals are non-stationary. The table reports 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, the stronger the rejection of the null hypothesis.

To evaluate the appropriateness of the selected empirical approach, we test whether the errors of the regression are stationary. To do so, we apply the Pesaran test, as suggested Kapetanios, Pesaran, and Yamagata.[28] The results are presented in the table 7. Reassuringly, the test results reject the hypothesis of nonstationary residuals.

Saving Retention in Latin America and the Caribbean and the Rest of the World

How do the results obtained for Latin America and the Caribbean 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: Latin America and the Caribbean; advanced economies; eastern Europe;[29] developing Asia; the Middle East, North Africa, and Pakistan (MENA); and sub-Saharan Africa (SSA). The countries included in each group—other than Latin America and the Caribbean, which is defined above—are listed in table 8.

For each region we estimate equation 1 using the GM-FMOLS estimator. The results (with and without time fixed effects) are reported in table 9. The estimated saving retention coefficient in Latin America and the Caribbean 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, Latin America and the Caribbean'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.

28. Pesaran (2007); Kapetanios, Pesaran, and Yamagata (2011).
29. Data for these countries are available beginning in the 1990s.

TABLE 8. Country List by World Bank Classification

Advanced Economies		*Eastern Europe*	*Developing Asia*	*MENA*	*Sub-Saharan Africa*	
Australia	Luxembourg	Albania	Bangladesh	Algeria	Angola	Lesotho
Austria	Netherlands	Armenia	Bhutan	Bahrain	Benin	Madagascar
Belgium	New Zealand	Belarus	Cambodia	Egypt	Botswana	Malawi
Canada	Norway	Bulgaria	China (mainland)	Iran, I.R. of	Burkina Faso	Mali
China (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. China)	Latvia	Philippines	Oman	Congo, Rep. 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 Rep.	Gambia, The	Swaziland
Israel		Russian Federation		Tunisia	Ghana	Tanzania
Italy		Slovakia		Turkey	Guinea	Togo
Japan		Slovenia		United Arab Emirates	Guinea-Bissau	Uganda
Korea, Rep. of		Ukraine			Kenya	Zambia

TABLE 9. Feldstein-Horioka-Type Estimates for World Regions, Panel Regressions[a]

Region	*Beta without time dummy*	*Beta with time dummy*
Latin America and the Caribbean	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***

***Statistically significant at the 1 percent level.
a. The table reports the coefficient estimate β in equation 1.

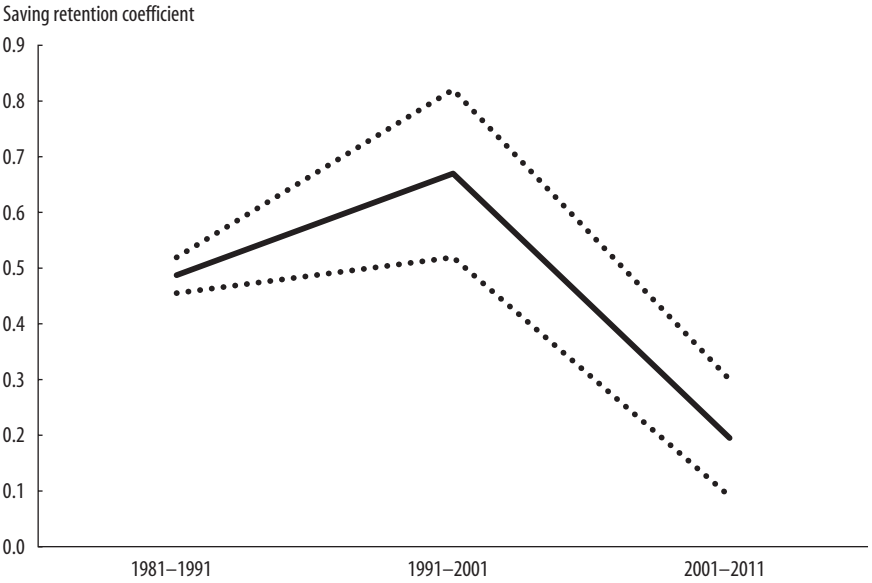
Saving Retention in Latin America and the Caribbean over Time

To explore how the estimated saving retention in Latin America and the Caribbean changed over time, we estimate the panel group coefficient for the region using non-overlapping decades: that is, (i) the 1980s, (ii) the 1990s, and (iii) the 2000s. The estimated coefficients (and standard errors) by decade are reported in figure 1. The estimated coefficient was relatively high in the 1980s (0.49), the period known as the Lost Decade in Latin America and the Caribbean 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 in 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 Latin America and the Caribbean 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.

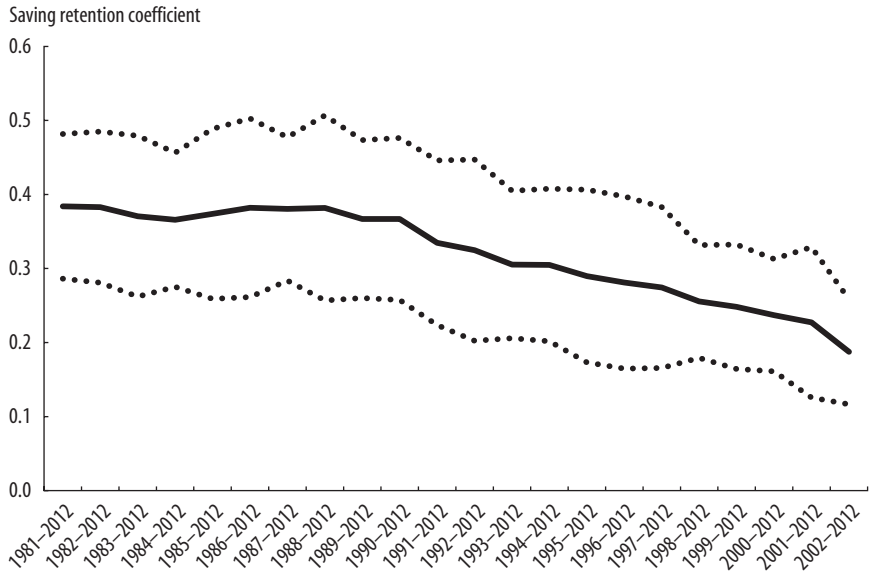
To probe this question more deeply, we reestimate the relationship between saving and investment using a different sampling strategy: rather than using non-overlapping decades, we compute a rolling regression whereby we sequentially drop years from the sample. Thus, in figure 2, the first observation represents the panel estimate for the full Latin American and Caribbean sample over the entire period (1980–2012). This is the same as the panel group estimate reported in table 6. Next, the figure shows the estimate corresponding to the

FIGURE 1. Saving Retention Coefficient for Latin America and the Caribbean over Time[a]



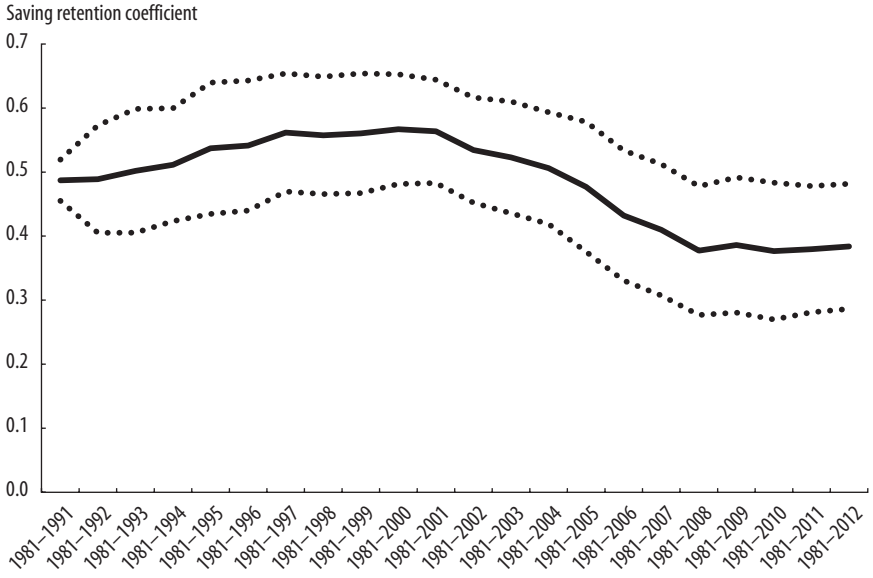
a. This graph shows the estimated saving retention coefficient for every period. The dotted lines represent the 5 percent confidence interval.

FIGURE 2. Rolling Regression: Dropping Years[a]



a. This graph shows the estimated saving retention coefficient for every period. The dotted lines represent the 5 percent confidence interval.

FIGURE 3. Rolling Regression: Adding Years[a]



a. This graph shows the estimated saving retention coefficient for every period. The dotted lines represent the 5 percent confidence interval.

period 1981–2012, then 1982–2012, and so on, up to the last point estimate (2002–12). In this case, the panel group estimates show a more nuanced picture. As shown, the estimated saving retention coefficients are high and flat as long as the years of the 1980s remain in the sample. After 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.

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 (see figure 3). The initial estimates of the saving retention coefficient are approximately 0.49, but the coefficient estimates gradually drop beginning with the inclusion of the late 1990s. 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 was no further increase in de facto financial integration in the region.

The bottom line is that the aggregate panel group estimate of the saving retention coefficient for Latin America and the Caribbean 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.

Saving Retention within the Latin American and Caribbean Region

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

—LAC-7: Argentina, Brazil, Chile, Colombia, Mexico, Peru, and Venezuela;

—Rest of the region: Bahamas, Barbados, Belize, Bolivia, Costa Rica, Dominican Republic, Ecuador, El Salvador, Guatemala, Honduras, Jamaica, Panama, Paraguay, and Trinidad and Tobago.

LAC-7 comprises the largest economies in the region, which together account for more than 90 percent of regional GDP. There is a trade-off in estimating β in equation 1 using smaller samples. The asymptotic convergence of the estimated β to the true coefficient is valid when N is large.[30] For a smaller N, the probability that the asymptotic convergence holds is lower. Nevertheless, to explore possible heterogeneity within Latin America and the Caribbean, we estimate equation 1 using the GM-FMOLS for each group, over ten-year (non-overlapping) periods. The results are reported in figure 4.

The line in figure 4 is the panel group estimate of β for the region (that is, the same as in the preceding sections). The bars in the chart graph the subregional estimates over the different decades. Figure 4 reveals that the two groups behave differently. In particular, LAC-7 exhibits smoother dynamics than the rest of the region. The fall in the estimated saving retention coefficient in Latin America and the Caribbean that is observed over the last decade is largely driven by the decline observed in the group of smaller countries in the region.

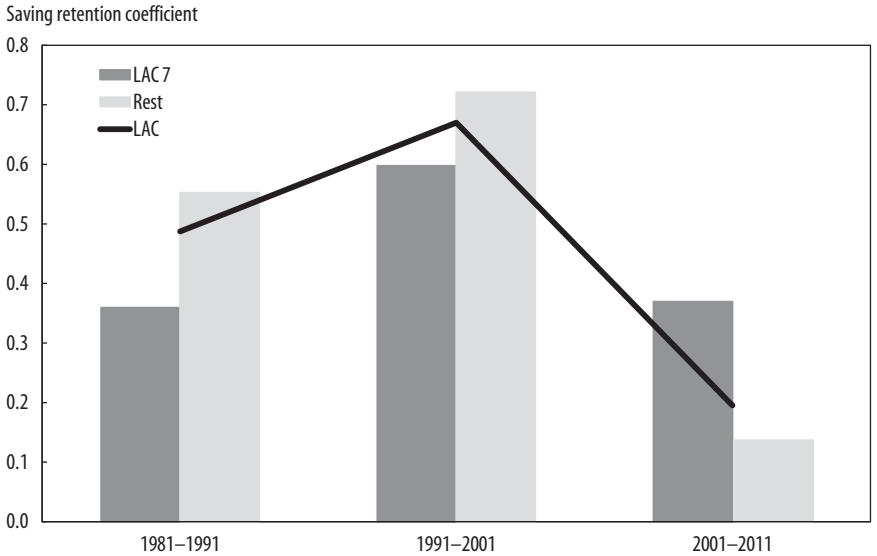
As a variant of the preceding approach, we group the twenty-four countries along geographical lines:

—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.

30. Pedroni (1997).

FIGURE 4. Saving Retention Coefficient for Subregions of Latin America and the Caribbean, by Size of Economy

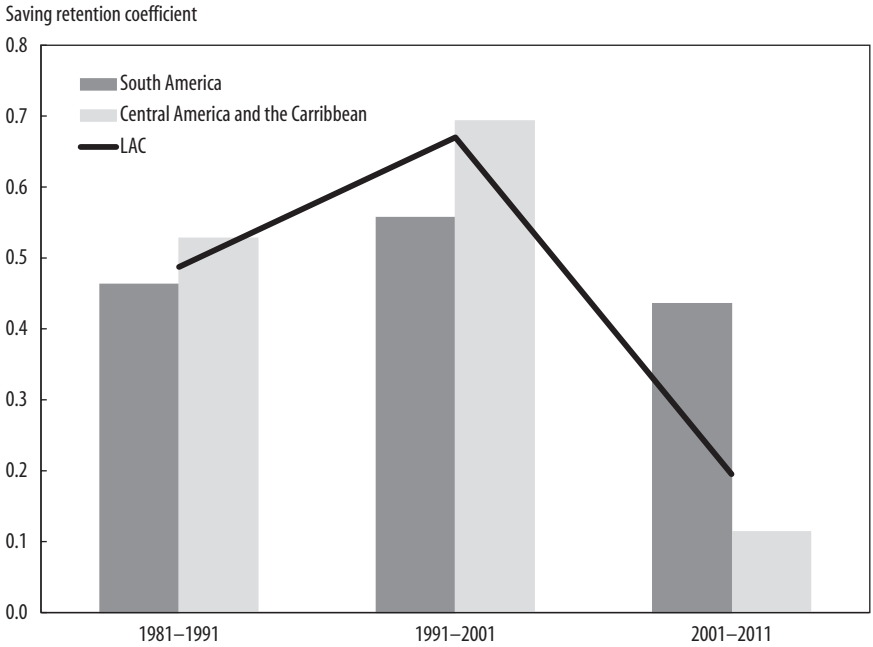


The results are presented in the figure 5. As in figure 4, the line is the panel group estimator for the whole region, and the bars are the subregional estimates over the different decades. Figure 5 shows that the panel estimate in the region seems to be driven almost entirely by Central America and the Caribbean. In contrast, the South America group exhibits a much 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 using the full regional sample hides a significant degree of intraregional heterogeneity.

Conclusion

Since the late 1980s, many countries in Latin America and the Caribbean 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 region.

FIGURE 5. Saving Retention Coefficient for Subregions of Latin America and the Caribbean, by Geographical Location



Using Pedroni's cointegration 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 Latin America and the Caribbean. While the aggregate (average) correlation coefficient in Latin America and the Caribbean is 0.39, there is variance across subgroups in Latin America and the Caribbean, 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 the region has been declining over time, particularly up to the global financial crisis in 2008. This fall suggests that financial integration 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. Low national saving

rates remain a binding constraint on investment and growth in Latin America and the Caribbean.

In the introduction, we posed a crucial question: can an investment push in Latin America and the Caribbean be financed by foreign saving only? That is, if good investment opportunities were to emerge (for example, due to 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.[31] In the data, national saving 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 vice versa. 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.[32] In this view, the region's past economic and political instability has translated over time into poor investment opportunities and 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.[33] 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 the causation probably runs in both directions, as argued by the Commission on Growth and Development.[34] Consequently, given the positive correlation found between domestic investment and national saving rates, policies to promote national saving and policies to promote investment should be consistent. If pro-saving

31. 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.

32. See Gavin, Hausmann, and Talvi (1997).

33. See Mankiw, Romer, and Weil (1992).

34. Commission on Growth and Development (2008).

policies 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-saving 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.[35] With sound and stable policy frameworks, Latin America and the Caribbean would likely achieve both higher investment and higher national saving as part of a single 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.

Appendix

We estimate equation 1 using GM-FMOLS for four different subregions:

—Andean countries: Bolivia, Colombia, Ecuador, Peru, and Venezuela;

—Caribbean countries: Bahamas, Barbados, Dominican Republic, Jamaica, and Trinidad and Tobago;

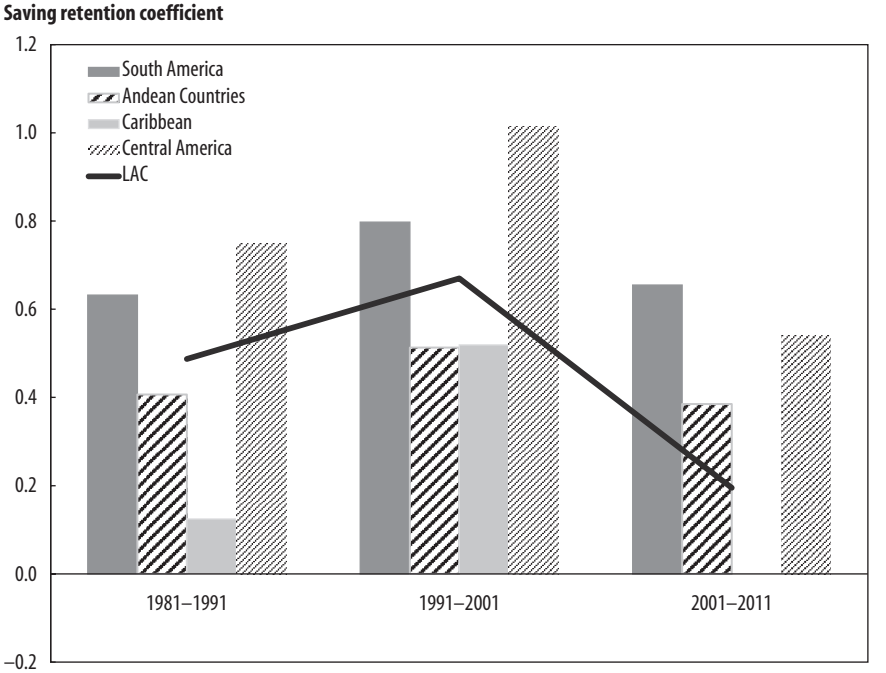
—Central America: Belize, Costa Rica, El Salvador, Guatemala, Honduras, Mexico, and Panama;

—South America: Argentina, Brazil, Chile, Paraguay, and Uruguay.

We compute the panel regressions for each group and for the different decades. The results are shown in figure A1. The line in figure A1 is the panel group estimator for the region (that is, the same as in the preceding sections); the bars in the chart are the subregional estimates over the different decades. The figure 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 among the Caribbean countries (where the coefficient estimate for the last decade was negative) and Central America (although in this case the coefficient estimate fell from very high levels in the preceding decade). The coefficient estimates were relatively more stable among the Andean group, where the dynamics trace those of the regional (aggregate) average. Finally, in the South American countries, the estimated correlation remained relatively high throughout the estimation period.

35. See Reinhardt (2008) and Grigoli, Herman, and Schmidt-Hebbel (2015) for a review of the literature.

FIGURE A1. Saving Retention Coefficient for Latin America and the Caribbean, by Geographical Subgroups



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