Should Latin America Save More to Grow Faster?

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Abstract

A widely shared view holds that there is no policy-exploitable causal connection from saving to growth because domestic saving is fully endogenous, optimally determined, or substitutable by foreign saving. Yet, abandoning these assumptions, which are questionable in the real world of frictions, leads to three channels through which domestic saving may promote growth: a *real interest rate* channel, whereby saving reduces the cost of capital (the sovereign risk premium) and enhances macro sustainability; a *real exchange rate* channel, through which saving leads to a more

competitive real exchange rate; and an *endogenous saving* channel, whereby saving follows growth but in a less than perfectly elastic manner, thereby amplifying the effects of the first two channels. Broad-based econometric evidence supports all three channels and suggests that Latin America, a historically low growth-low saving region, would benefit from boosting its saving rate, especially in countries with recurrently weak balance of payments and persistent domestic demand pressures on the non-tradable sector.

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1. Introduction

The debate as to whether saving matters for growth, or is just a corollary of growth, is an old and familiar one. Much of the original empirical debate has centered on causality, found to be flowing mostly from growth to saving, rather than the other way around (Carroll and Weil, 1993). Yet, a more recent strand of literature has detected robust evidence indicating that countries that rely on external saving, rather than domestic saving, grow less (Aizenman, Pinto and Radziwill, 2004; Prasad, Rajan and Subramanian, 2007). Conversely, foreign saving has been found to flow more to countries with lower growth prospects, as per the Gourinchas and Jeanne (2013) puzzle. Both observations suggest that domestic saving matters for growth.

But does it? Logic dictates that a policy-exploitable causal connection between saving and growth should not exist in an idealized world where at least one of the following three conditions holds: (i) saving is perfectly growth-elastic, hence does not constrain growth (the *perfect elasticity condition*); (ii) foreign saving (a current account deficit) offsets any shortfall in domestic saving, leaving growth unaffected (the *perfect substitutability condition*); or (iii) there is no scope for policy because private saving is constrained efficient (the *perfect efficiency condition*). Yet, in the real world all three conditions are questionable. First, the perfect efficiency condition may fail to obtain on account of un-internalized externalities. Second, even when saving follows growth (a well-established fact), it may not do so in a perfectly elastic manner, such that the growth-induced saving response to an autonomous increase in investment fully finances it. Third, even if foreign saving emerges swiftly to fill up a domestic saving gap, it may not be a perfect substitute on account of frictions.

The failure to meet the above conditions opens up the space for three channels through which saving can causally affect growth. The first channel, the *real interest rate (IR) channel*, relates to the cost of capital. Once sovereign default risk is introduced, decentralized agents can under-save (relative to what would be socially optimal) because they do not take into account the adverse impact of their individual borrowing on the collective cost of foreign debt or the negative externalities in the event of a balance of payments crisis. Hence, a low saving rate can affect growth by undermining macroeconomic sustainability. The second channel, the *real exchange rate (ER) channel*, relates to external competitiveness. By inducing a persistent real exchange rate appreciation, a switch in the composition of saving, from domestic to foreign, can slow growth by shrinking the relative size of the tradable sector. Decentralized economic agents can under-save in this case because they fail to internalize the technological spillovers and other positive learning externalities associated with a thriving tradable sector. The third channel, the *endogenous saving (ES) channel*, obtains when saving follows growth but in a less than perfectly elastic manner. In this case, which we will refer to as the “normal” or “not on steroids” ES, the ES channel amplifies the impact on growth that a change in saving would have via any of the other two channels.

These channels have distinct macroeconomic signatures, thereby leading to several testable patterns. The IR channel dominates when the low saving rate leads to current account deficits that threaten balance of payments viability, thereby raising the sovereign risk premium. In this case, countries that save less should have a higher risk premium and grow less, despite having a more competitive real exchange rate. Instead, the ER channel dominates when a low saving rate pushes domestic demand above national income, putting pressure on the supply of non-tradables and widening the current account deficit but without affecting the sovereign risk premium. In this case countries that save less should have a less competitive real exchange rate and grow less. Finally, the ES channel dominates when saving turns sufficiently growth-elastic

(the ES on steroids case). In this case, the ER and IR channels cease to operate because growth becomes self-propelled and saving is no longer a constraint.

The channels can interact and operate in sequence, becoming dominant at different points in time. Thus, a period of IR channel dominance may be followed by improvements in macro-financial policy that set the conditions for a return of the ER channel. In turn, a prolonged period of current account deficits and uncompetitive real exchanges under the ER channel can bring back IR dominance.

We test for such patterns empirically based on a simultaneous equations model that focuses on medium-term equilibrium relationships and uses an extensive set of controls to correct for structural as well as policy diversity across countries. The model is driven by a set of elasticities linking domestic saving, investment, the real exchange rate, the sovereign risk rating, and growth. Using data for 119 countries over the 1980-2012 period, these elasticities are estimated through both structural-form ordinary least squares (OLS) and reduced-form instrument-based OLS regressions. A benchmarking methodology is used to explore the macro patterns associated with the channels, ensuring that countries can be properly compared and that deviations from benchmark can be interpreted as being largely driven by differences in policy or policy-driven institutions.

The empirical results broadly support the IR and ER macroeconomic patterns. In particular, under-saving correlates robustly with real exchange rate over-valuation (all relative to benchmark), which suggests a statistical dominance of the ER channel for the entire sample. On average, countries that under-save have over-valued real exchange rates, rely less on external demand (are less export oriented), grow slower, and invest less. However, the countries that deviate the most from the ER pattern tend to fit the IR pattern, which associates under-saving with low growth despite undervalued real exchange rates. As expected, the under-savers and over-savers in this latter group differ considerably as regard their country risk ratings, with the under-savers having the worst ratings, the over-savers the best. We also find support for a normal (hence not dominant) ES channel. The latter mainly accrues from corporate saving, by far the most growth-elastic component of domestic saving.

While structural OLS estimates yield limited impacts of saving on growth, the reduced-form instrumented estimates, when available (only some elasticities could be retrieved due to the high endogeneity in the system), point toward substantially higher impacts. Moreover, the estimated strength of these effects is much greater for countries with current account deficits in the middle-income stages of development. Hence, domestic saving mobilization policies make more sense for middle-income countries with weak balance of payments.

Applying the analysis to Latin America, we find that the region has been a clear outlier relative to the world average in that the IR channel played a uniquely important role during the crisis times of the 1980s and 1990s. During the more recent commodities boom period that ended around 2011, the region mostly re-aligned itself along a more typical ER pattern, with much improved sovereign risk ratings and substantial real exchange rate appreciations. After 2011, however, the falling terms of trade have tended to realign the region along an IR direction, as several low-saving commodity-exporting Latin American countries have experienced substantial declines in country ratings accompanied by large real exchange rate depreciations.

The rest of this paper is structured as follows. Section 2 discusses the three saving and growth channels, relating them to the literature, and sets out testable hypotheses. Section 3

models these channels in a simple way, paving the way for the econometric work presented in Section 4. Section 5 explores macroeconomic patterns consistent with the channels using a benchmarking approach. It also locates and contrasts the Latin American region and individual countries within the region with respect to these patterns. Section 6 concludes with a brief discussion of policy implications.

2. The three channels linking saving and growth and testable hypotheses

Saving would not matter for growth if either one of three conditions hold. Under the *perfect substitutability condition*, all that matters for growth are investment prospects; whether investment is financed by domestic or foreign saving is immaterial. Higher foreign saving alters the distribution of growth dividends (from local residents to foreigners) but does not affect growth itself. Instead, under the *perfect elasticity condition*, domestic saving does not constrain growth because the saving required for growth automatically becomes available as needed, that is, saving responds “on steroids.” Finally, under the *perfect efficiency condition*, the saving decisions of private agents are optimal given the constraints and the government has no comparative advantage to improve the outcome; hence, while domestic saving may be a binding constraint on growth, there is no role for policy.¹

Departing from any of these three conditions has major implications. Dropping the perfect substitutability condition opens the door to the *real interest rate (IR)* and *real exchange rate (ER)* channels linking saving to growth. Dropping the perfect elasticity condition gives rise to the normal (not “on steroids”) *endogenous saving (ES)* channel, through which the action of the other two channels becomes amplified. In this section we review each of these channels in light of the relevant literature and set out some key testable hypothesis. We start with the most widely recognized, hence less controversial, ES channel.

(a) The ES channel

In the conventional neoclassical growth model, since output growth is a function of the rate of technological change, it makes sense to consider how saving may endogenously respond to changes in expected growth. Under rational inter-temporal consumption smoothing with perfect foresight, higher expected growth (hence higher consumption tomorrow) should raise consumption today, thereby reducing saving instead of increasing it (Gourinchas and Rey, 2013). However, this result can be reversed in various, plausible ways. One way is to introduce uncertainty, so that precautionary savers save more aggressively in order to maintain an optimal wealth to income ratio when their income grows faster (Leland, 1968; Zeldes, 1989). An alternative is to make saving a function of expected productivity: if productivity is envisioned to increase in the future, agents save and invest more today in order to reap the benefits of higher returns tomorrow (Busso, Fernández, and Tamayo, 2015).

¹ Under the perfect efficiency condition, while the government would not be justified in *directly* influencing private saving decisions, it could still foster growth through policies that improve the enabling environment, thus, *indirectly* affecting saving. By expanding the opportunity set of households and firms, a better enabling environment should enhance saving decisions. Note also that deviations from social optimality could also reflect incomplete markets (as in the case of overlapping generation models), private time inconsistency (as in the case of hyperbolic discounting), or public time inconsistency. In the latter case, the introduction of overly generous social safety nets could lead to under-saving if private agents rely unduly on the state to support them in old age but the state fails to mobilize the fiscal saving required to uphold its promises to the elderly.

An overlapping generations life cycle setting can accentuate the private saving response to growth, as growth raises the income of the middle-agers who save more than both the young and the old (Modigliani, 1986). Also, consumption can lag income growth (i.e., saving can lead growth) due to habit formation (Campbell and Cochrane, 1999). On the firms' side, as income and profits expand, corporate saving can rise as firms limit dividend distribution to mobilize internal finance (Fazzari et al, 1988) or increase output prices relative to wages (Lewis, 1954; Kaldor, 1958). Finally, a more controversial strand of literature (Rowthorn, 1982) extends the Harrod-Domar, Keynesian-type constructs to support the ES on steroids view that domestic saving responds to investment on a one-to-one basis.

There is broad empirical support for the ES channel. In panel regressions, output growth is found to be a significant determinant of private saving (Loayza, Schmidt-Hebbel and Servén, 2000). In Granger causality studies, growth generally causes saving (Carroll and Weil, 1993).² Countries undergoing growth transitions are found to end up with permanently higher saving rates (Rodrik, 2000) and saving accelerations are found to be mostly preceded (rather than followed) by stronger output growth (Ebeke, 2014) or total factor productivity growth (Busso, Fernández, and Tamayo, 2015). Consistent with this perspective, Guariglia, Liu and Song (2011) and Yang, Zhang and Zhou (2011) find that the Chinese growth acceleration of the past quarter of a century was what drove increases in corporate saving.

As far as we know, the critical condition for self-propelling growth (the ES on steroids claim that an autonomous increase in expected productivity generates a marginal increase in domestic saving sufficient to fully cover the increase in investment triggered by the rise in productivity) has never been tested (nor, for that matter, discussed). Arguably, however, the very existence of balance of payments tensions and crises provides an indirect indication that the shortages of domestic saving that occur in the real world matter. Thus, a strict ES on steroids view of the world would be ruled out if domestic saving rises with growth but not enough to avoid widening current account deficits. By potentially undermining balance of payments sustainability, a less than perfectly elastic saving response to growth makes room for the IR channel, to which we now turn, to become operative.

(b) The IR channel

In the closed economy Ramsey-Cass-Koopmans inter-temporal optimization model with exogenous technological change, agents choose how much to save by comparing the marginal return on saving (the marginal product of capital) to the marginal cost of saving (the rate of time preference). A lower rate of time preference implies higher saving, which raises the growth rate of consumption and output during the transition to the economy's steady state. Once there, higher domestic saving raises income but no longer affects growth. However, once technological change is endogenized (Romer, 1986), saving becomes relevant for growth even in the steady state. Furthermore, as long as private agents do not internalize the learning externalities from higher saving (hence higher investment), the perfect efficiency condition fails to hold, thereby opening a role for policy.

This policy role vanishes in a financially open economy, however, if domestic and foreign saving are perfect substitutes. In this case, the uncovered interest rate parity condition

² The failure to find clear empirical backing for saving causing growth may simply reflect data limitations as few countries have engaged in massive efforts to boost their saving rate in a way that clearly stands out in the data in the form of sufficient within-country variation over time.

holds and the world (real) rate of interest becomes the opportunity cost of saving. Through an inflow of foreign saving, the marginal product of capital immediately adjusts to equalize the world cost of saving with the world rate of return on saving. Hence, the rate of growth of consumption immediately adjusts to its steady state level (the world's growth rate of productivity) while the rate of growth of local output immediately adjusts to equal the local's growth rate of productivity (Gourinchas and Rey, 2013). There is therefore under these conditions no link from domestic saving to growth, nor any role for saving promoting policies. This conclusion remains basically unchanged when technological change is endogenous (Turnovsky, 2000).

However, once sovereign default risk is introduced, reflecting for instance collateral constraints, domestic and foreign savings are no longer perfect substitutes. Beyond some optimal level, substituting domestic saving with foreign saving raises the cost of capital (as measured by the country risk premium), thereby reducing steady state growth (Turnovsky, 2000). Thus, saving matters for growth in the presence of credit constraints. Moreover, foreign borrowing introduces an un-internalized externality. Agents fail to take into account that as they individually increase their amount of borrowing, they raise the country's debt-to-capital ratio, raising the cost of debt to all. Thus, there is a role for policy as well.

This purely "ex-ante" (pre-crisis) characterization of the IR channel needs to be complemented from an "ex-post" (post-crisis) perspective. In an imperfectly open economy with a non-tradable sector, the real exchange rate will depreciate as the country risk premium rises, reflecting an increased risk of a balance of payments crisis and mounting concerns regarding the associated costs, which might include inflation, financial repression, and an economic slump. If and when the crisis hits, access to foreign borrowing is lost, which is possibly compounded by capital flight, and the cost of capital rises sharply. Again, individual agents fail to internalize the crisis externalities, which further opens the role for policy. Note that, by raising the marginal return on domestic saving, the crisis may thus push domestic saving back up.

The IR channel is at the core of an ample body of literature, going back to the analysis of the links between foreign debt accumulation and balance of payments crises (Eaton and Gersovitz, 1981), and subsequently connected to sudden stops (Calvo, 1998; Mendoza, 2010), debt sustainability (Reinhart and Rogoff, 2013), and growth (Cerra and Saxena, 2008). A more recent strand of literature has modeled balance of payments crisis as coordination failures caused by collateral constraints and un-internalized pecuniary externalities that translate into under-saving (Jeanne and Korinek, 2010). There is also an emerging literature linking saving in foreign assets to macroeconomic volatility (Fogli and Perri, 2015).

(c) The ER channel

Switching the spotlight from the marginal cost of saving to its marginal return brings up the ER channel. Growth rises when higher (lower) saving durably depreciates (appreciates) the real exchange rate, thereby raising (lowering) the marginal rate of return of investing in the relatively capital intensive tradable sector. The ER channel has two legs, the first linking saving to the real exchange rate, the second the real exchange rate to growth.

Starting with the first leg, with less than perfect factor mobility across firms, sectors or borders, lower saving (hence higher domestic demand) must clearly appreciate the real exchange rate. While an excess demand for tradables can be resolved solely via quantities (a

widening of the current account deficit as imports increase) at given world prices, an excess demand for nontradables should raise their price relative to that of tradables (Dornbusch, 1980). Over time, however, the real exchange rate appreciation should induce a supply response via a reallocation of factors from the tradable to the nontradable sector (Corden, 1981). Hence, the permanence or durability of the real appreciation crucially depends on the elasticity of the factors of production and their mobility across firms, sectors, or borders.

In a two-factor setting (physical capital and labor) with perfect cross-sector labor mobility and cross-border capital mobility, the equilibrium real exchange rate does not appreciate in response to a fall in domestic saving. Instead, it is strictly determined by Balassa-Samuelson-type supply side effects (Rogoff, 1992). This ceases to be the case, however, when factor reallocation across sectors is slow and costly, due for example to adjustment costs for investment (Morshed and Turnovsky, 2004), or if sector-specific human capital is added as a factor of production (Brock and Turnovsky, 1993). In this latter case, even when physical capital can be freely borrowed across borders (thereby equalizing marginal rates of return), reflecting learning frictions, human capital must be accumulated locally, sector by sector. Thus, in either case, reflecting induced scarcities, an increase in aggregate demand can durably appreciate the real exchange rate. Irreversibilities and path dependence (hysteresis) can further prolong these effects. For all such reasons, the impact of saving on the real exchange rate can be durable enough to make saving relevant.

On the empirical side, the first leg of the ER channel gets support from an early strand of literature (Bergstrand (1991), De Gregorio et al. (1993)) that documents the importance of demand factors as determinants of real exchange rates. At the same time, a large body of more recent literature (Banerjee and Duflo, 2005; Hsieh and Klenow, 2009) finds a very wide dispersion of productivities and returns across firms and sectors in developing countries, *prima facie* evidence that factors are slow to reallocate. Importantly, however, given that productive resources should gradually re-allocate to their best uses, the real exchange rate should eventually return to its long-run Balassa-Samuelson equilibrium. A predictable and durable link between saving and the real exchange rate can therefore only remain present (hence be detected in the data) in a stochastic world of sluggish factor reallocation where recurrent saving shocks keep throwing the real exchange rate away from its long-run equilibrium. As we will argue in Section 5, such saving fluctuations should naturally arise in a world buffeted by domestic or external macroeconomic shocks.

When it comes to the second leg of the ER channel, the key paper is Rodrik (2008), which finds that countries with more depreciated real exchange rates have larger tradable sectors and grow faster.³ Rodrik posits that tradables are special in that they produce more growth-enhancing positive externalities than non-tradables that are not necessarily internalized by individual economic agents, thus opening the space for policy action.⁴ A parallel strand of literature (Hausmann et al., 2005; Berg et al., 2008) finds that growth spurts are more likely to

³ Notice that higher domestic saving should also be naturally associated with stronger current accounts, greater export orientation and, hence, a higher ratio of external to domestic demand. The logic of the ER channel therefore also implies the existence of a link between growth and the composition (external versus internal) of aggregate demand.

⁴ Tradable sector externalities can also take the form of learning-by-investing spillovers in a setting where the tradable sector is more capital intensive than the non-tradable sector, as in Korinek and Serven (2010). Berg and Miao (2010) found some evidence in support of tradable sector externalities. However, the identification of greater positive externalities in tradables and the role of externalities in the link between the real exchange rate and growth remain elusive to date (see, for instance, Giles and Williams, 2000; and Harrison and Rodriguez-Clare, 2009).

occur in countries with more competitive exchange rates. Finally, in a somewhat similar vein, Levy Yeyati et al. (2013) find that countries that pursue exchange intervention policies geared at keeping or enhancing external competitiveness display better growth performance, although the transmission channel between the exchange rate and growth is via higher investment, rather than via increased exports.⁵

Be it as it may, the ER channel, particularly the link between saving and the real exchange rate, has not yet been fully explored in the theoretical growth literature. Korinek and Serven (2010) and Itskhoki and Moll (2014) develop models where the relative productivities of the tradable and non-tradable sectors (i.e., the real exchange rate) in a Romer-type endogenous growth model become functions of aggregate demand. Because externalities are not internalized, private agents save and invest too little, the tradable sector is too small, and the economy grows less than optimally.⁶ Yet, neither of these two papers directly focuses on saving itself (in both cases, the first-best intervention is a direct investment subsidy or a tax on nontradables rather than a saving boost).⁷ Nonetheless, both papers implicitly recognize that raising saving can be a less distortionary, hence second-best, approach to boosting growth.

(d) Testable hypotheses

The fact that the three channels linking saving and growth have theoretically distinct macroeconomic signatures leads to empirically testable patterns. Where the ER channel dominates, countries that save less should have a less competitive real exchange rate, be less export oriented (hence, have a higher ratio of external to internal demand), and grow less. Where the IR channel dominates, countries that save less should have a higher sovereign risk premium, and grow less, despite having a more competitive real exchange rate. Finally, for the ES channel not to be on steroids, domestic saving should rise with growth but not enough to avoid current account deficits.

At the same time, we would expect the ER and IR channels to interact and operate in sequence. Thus, a period of IR channel dominance may be followed by improvements in macro-financial policy that set the conditions for a return of the ER channel. In turn, a prolonged period of current account deficits and uncompetitive real exchanges under the ER channel can bring back IR dominance.

Some important non-linearities are also to be expected. In particular, the IR channel should become operative only when current accounts have deteriorated sufficiently to undermine balance of payments sustainability. Thus, where high saving rates have already led to current account surpluses, a further increase in the saving rate should have very limited

⁵ A closely related literature focuses on the resource curse (Benigno and Fornaro, 2013) and the Dutch disease (Van der Ploeg, 2010). It shows that broader access to foreign capital or a natural resource boom can slow down growth by inducing a real exchange rate appreciation that promotes the development of the non-tradable sector at the expense of the tradable sector. Typically, this literature does not contemplate long-term capital accumulation and does not focus on saving *per se*. However, it has similar implications for saving as the ER channel. Indeed, an increase in exports of natural resources can result in a decline of domestic saving, once the resulting decline in the stock of (non-renewable) natural resources is properly accounted for (World Bank, 2006).

⁶ Key to the results in both papers are assumptions limiting the cross-border equalization of returns, through agency frictions in the case of Itskhoki and Moll (similar to those in Aghion et al, 2009), and a self-imposed assumption of a financially-closed economy in the case of Korinek and Serven.

⁷ Korinek and Serven focus on international reserve accumulation. Itskhoki and Moll establish a link between saving, the real exchange rate, and growth in a latter part of their paper, where they introduce a nontradable sector.

effects on growth. Conversely, where domestic savings are weak enough to generate chronic current account deficits, an increase in the saving rate, by reducing the risk of default, should have much larger beneficial effects on growth.

3. The analytical framework

To help analyze empirically how the three above channels interact, identify their imprints, and explore the above hypotheses while keeping things as simple as possible, we posit a highly stylized macro model that focuses on medium term equilibria.⁸ While the lack of a dynamic framework is an important limitation (more on this below), it greatly simplifies the estimation. At the same time, to facilitate comparisons across a broad and heterogeneous set of countries, we develop a model-based benchmarking methodology that fully exploits the systemic linkages across macroeconomic variables.

(a) A minimalist model of saving and growth

The demand side of the model is captured by a domestic (IS-type) and external (interest rate parity) equilibrium conditions (the signs above the variables denote the direction of the first partial derivatives):

$$S_F = I(\bar{e}, \bar{\rho}) - S_D(\bar{e}, \bar{g}) \quad (1)$$

$$\rho = \rho^* + \sigma(r) \quad (2)$$

In the IS equation the current account (foreign saving, S_F) equals the difference between investment, I , and domestic saving, S_D . Both investment and domestic saving are functions of e , the real exchange rate (the ER channel). In addition, investment also depends on the real interest rate, ρ , which is the sum of the world interest rate, ρ^* , and σ , the sovereign risk premium (the IR channel). The latter moves inversely with r , the sovereign risk rating. Domestic saving also depends on the rate of growth, g (the ES channel).

The supply side of the model is a reduced-form growth equation that collapses stocks (capital) and flows (investment), based on a time-invariant capital-output ratio; in this case, growth is a simple function of investment, the real exchange rate (the ER channel) and the country rating (the IR channel):⁹

$$g = g(I, \bar{e}, r) \quad (3)$$

The model is closed with two reduced-form functional expressions; the first sets the real exchange rate as a function of S_F , the current account (the ER channel) and r , the sovereign rating (the IR channel); the second links the country rating to the current account deficit:

⁸ We leave aside all dynamics, including short-term Keynesian output dynamics around full employment or exchange rate dynamics around the interest rate parity condition, medium-term dynamics such as those underlying consumption boom-appreciation cycles, and longer-term dynamics such as the exchange rate appreciations resulting from the build-up of foreign assets under current account surpluses.

⁹ See Appendix A for a simple derivation.

$$e = e^+(S_F, r^+) \quad (4)$$

$$r = r^-(S_F) \quad (5)$$

Replacing ρ in the investment function by r , using (2), and S_F in the real exchange rate and country rating equations by $I - S_D$, using (1), the model can be linearized for the endogenous variables and expressed as a function of a set of other control variables (the C 's) that may include policy and structural country characteristics as well as domestic or external shocks (more on this below):

$$e = \beta_e^+(I - S_D) + \gamma_e^+ r + C_e \quad (6)$$

$$r = \gamma_r^-(I - S_D) + C_r \quad (7)$$

$$I = \beta_I^+ e + \gamma_I^+ r + C_I \quad (8)$$

$$S_D = \alpha^+ g + \beta_S^- + C_S \quad (9)$$

$$g = \delta^+ I + \beta_g^- e + \gamma_g^+ r + C_g \quad (10)$$

The coefficients of the endogenous variables in this system are structural elasticities (signs as marked above the coefficients) that relate to each of the three channels (see Figure 1). The betas (β_e , β_I , β_S and β_g) are associated with the ER channel and denote the responsiveness, respectively, of: (i) the real exchange rate to net saving; (ii) investment to the real exchange rate; (iii) domestic saving to the real exchange rate; and (iv) growth to the real exchange rate. The gammas (γ_e , γ_r , γ_I , and γ_g) are associated with the IR channel, with analogous interpretations as those for the previous set of elasticities. Alpha (α) is associated with the ES channel, denoting the responsiveness of domestic saving to growth. Finally, delta (δ) is a general structural elasticity linking growth to investment, which reflects productivity.

The growth impact of an autonomous increase in gross saving:¹⁰

$$\frac{\partial g}{\partial S_D} = -\frac{A}{\Delta} \quad (11)$$

$$A = (\beta_e + \gamma_e \gamma_r)(\beta_g + \delta \beta_I) + \gamma_r(\gamma_g + \delta \gamma_I) \quad (12)$$

$$\Delta = 1 + \alpha A - \beta_e \beta_I + \beta_e \beta_S \quad (13)$$

Equation (12) breaks down all the possible means through which an increase in saving can affect growth. The first two terms jointly measure the effect of changes in saving on growth through the real exchange rate. According to the first term, by reducing the current account deficit, a gross saving boost depreciates the real exchange rate, via β_e and the ER channel. But by improving the country's risk rating (r), it also appreciates the real exchange rate, via $\gamma_e \gamma_r$ and the IR channel. Thus, the net impact on the real exchange rate of an increase in saving

¹⁰ See Appendix A for derivations.

ultimately depends on the relative strengths of the ER and IR channels, with the ER channel dominating the IR channel when $\beta_e + \gamma_e \gamma_r > 0$. According to the second term of A , an exchange rate depreciation boosts growth, both directly via β_g (by promoting the positive growth externalities of investing in the tradable sector), and indirectly via the interaction of β_I (the rise in investment due to changes in external competitiveness) and δ (the impact of capital accumulation on growth). The third and fourth terms of A also interact and jointly measure the growth impact of changes in saving through the sovereign risk rating. An increase in saving improves the country rating, as measured by γ_r , which in turn positively affects growth, both indirectly (by reducing the interest rate, thereby raising investment), via the interaction of γ and δ , and directly (by reducing or eliminating the negative growth externalities of balance of payments crises), via γ_g .

There are three feedback loops operating through the Δ term in equation (13). First, an increase in the rate of growth leads to higher gross saving, which sets into motion a multiplier effect coming from the ES channel, further boosting saving and growth via α (the αA term). The two additional feedback loops operate within the ER channel. According to the second feedback loop, a decline in gross saving has a multiplier effect by appreciating the real exchange rate, which, in turn (through wealth and income effects) tends to further reduce saving and stimulate consumption (the $\beta_e \beta_s$ term). In the third feedback loop, by appreciating the real exchange rate, the decline in saving reduces investment, thereby reducing the excess of investment over domestic saving, which partly offsets the effects of the initial depreciation (the $\beta_e \beta_I$ term).

Finally, the impact on the real exchange rate and the current account of an autonomous increase in investment is given by:

$$\frac{\partial e}{\partial I} = (\beta_e + \gamma_e \gamma_r) \frac{\partial(I - S_D)}{\partial I} = \frac{(\beta_e + \gamma_e \gamma_r)(1 - \alpha \delta)}{\Delta} \quad (14)$$

Assuming $\beta_e + \gamma_e \gamma_r > 0$, it follows from this expression that, if and when $\alpha \delta > 1$, the real exchange rate depreciates in response to a boost in investment as the supply of gross saving rises more than demand (net saving rises). This is the ES on steroids case, where domestic saving no longer matters for growth.

Figure 1 provides a graphical depiction of this model, where the transmission channels, interactions, and feedback loops can be grasped easily and in one go.

(b) Benchmarking methodology

In matrix form, the system (6)-(10) can be expressed as:

$$X_t^k = QX_t^k + RY_t^k + SZ_t^k + F_t^k \quad (15)$$

$$Z_t^k = R'Y_t^k + F_t^{*k} \quad (16)$$

where X_t^k is the vector of endogenous macro variables for country k at time t ; Y_t^k a vector of identifiable country-specific fundamentals; Z_t^k is a vector of identifiable policy choices that are

themselves partly endogenous to the country's fundamentals; and F_t^k is a vector of residuals that includes domestic and external stochastic shocks, as well as all remaining unidentified fundamentals or policy choices. Replacing Z_t^k from (16) in (15) and solving for X_t^k :

$$X_t^k = (I - Q)^{-1}[(R + SR')Y_t^k + (F_t^k + SF_t'^k)] \quad (17)$$

This yields a set of policy-neutral benchmarks, $\hat{X}_t^k$, such that:

$$\hat{X}_t^k = (I - Q)^{-1}(R + SR')Y_t^k \quad (18)$$

In turn, from (18), the following set of policy-neutral gaps, $\tilde{X}_t^k$, is inferred as the expected value of a country's deviation from benchmarks:

$$\tilde{X}_t^k = E\{X_t^k - \hat{X}_t^k\} \quad (19)$$

Thus, the benchmarks indicate where a country is expected to be for a given endogenous variable, taking into account its level of economic development, its non-policy-related structural characteristics, and the average policies and policy-related institutions of its peers. The gaps reflect country specificities, which can be unidentified endowments, preferences or policy choices embedded in the F term (in all cases omitted variables), or identified policy deviations from the average policies of peers embedded in the SF' term. To the extent that these omitted variables primarily reflect preferences or policy choices (rather than unidentified endowments), saving gaps become the result of policy choices (that can presumably be altered), rather than irreversible facts of life. In this case, on at least a first approximation, the gaps can be interpreted as reflecting the deviation of a given country's policies and policy-related institutions from the average of peer countries. Note also that because the gaps are linearly related through the Q matrix, the cross-correlations between them reflect the elasticities embedded in the model. In particular, the saving and real exchange rate gaps should be negatively correlated if the elasticity of the exchange rate with respect to changes in the current account deficit is positive and significant.

4. Econometric estimates

We first estimate each structural equation using ordinary least squares (OLS). Because cross-equation correlations between the endogenous variables are not accounted for, these estimates are biased. Moreover, they do not prove causality. To circumvent both of these problems, we subsequently use reduced-form instrumented estimates. Reflecting the high endogeneity, these estimates could be calculated only for a limited subset of elasticities. Even so, results suggest that the impact of saving on growth could be substantial.

(a) Data and specification

We use country-level yearly data for the period 1981-2012 and a sample of 119 countries, including low, middle and high-income countries.¹¹ To better capture medium-term equilibria, we run all the regressions on three-year averages instead of on the original annual

¹¹ See Appendix B for data definitions, statistics and sources.

data. However, to check for consistency and robustness, we repeat these estimates using dynamic ordinary least squares (DOLS) with yearly observations.¹² In addition, we control for short-term disequilibria through macro and financial crisis dummies (see below). To control for correlation of error terms, we use country clustering; to capture worldwide shocks, we use time fixed effects. To allow for possible asymmetries according to countries' balance of payments position (and, hence, to capture traces of nonlinearities), we introduce current account deficit dummies in the estimation of β_e and γ . To test for heterogeneity between countries at different levels of development, we divide the sample of countries by income (low, middle, high) and run separate sets of regressions for each income class. Finally, to test for differential saving propensities across sectors (households, corporates, public and external) we also present the results of saving regressions broken down by sectors, based on a smaller sample of about 50 countries.

To make countries comparable, we first control for the level of economic development (as proxied by per capita GDP), which, importantly, also controls for the more systematic component of the Balassa-Samuelson effect in the real exchange rate regression.¹³ We then include as additional controls key structural and institutional features (trade and capital openness, demographics, dependence on natural resources, dependence of foreign-earned income as determined by net unrequited transfers, quality of institutions, country size); fiscal policy (the fiscal balance and public sector consumption); exposure to external shocks (terms of trade changes, safe haven effects);¹⁴ and the country's record of macroeconomic and financial stability, as proxied by the incidence of inflationary or external debt crises. We distribute these controls across the five structural equations based on reasonable priors.

To eliminate the valuation biases that terms of trade changes introduce in nominal macro variables, we use the UN database that provides national accounts in real terms (i.e., where each component of aggregate demand is deflated by its own price deflator).¹⁵ To compare real exchange rate *levels* over time and across countries (rather than real exchange rate changes over time for the same country), we use as a measure of the real exchange rate the World Bank's purchasing power parity (PPP) conversion factor divided by the country's nominal exchange rate with respect to the U.S. dollar.¹⁶ The latter measures, relative to the U.S., the cost of the bundle of goods and services that makes up the gross domestic product of a country.¹⁷

We regress both the real exchange rate and the country rating against net domestic saving, where the latter equals the current account and is expressed as the difference between

¹² Dynamic ordinary least squares (DOLS) has been shown to provide efficient estimators of long-run relationships in panel data with co-integrated variables (Stock and Watson, 1993).

¹³ Thus, the residual (uncontrolled for) component of real exchange rates is more likely to reflect demand side than supply side effects.

¹⁴ Safe haven effects are measured by interacting market volatility (the VIX) with a safe haven dummy that equals one for the United States, Switzerland and Japan (and zero for all other countries).

¹⁵ For example, the investment-to-GDP ratio is likely to be underestimated if nominal variables are used in times of significant terms of trade gains because the GDP deflator rises faster than the investment deflator.

¹⁶ Rodrik (2008) uses a similar index albeit from a different database (Penn World Tables instead of the World Bank's WDI). Note that because the exchange rate is expressed in terms of dollars, an appreciation is reflected in an increase in e .

¹⁷ Although the PPP conversion factor series was recently updated (after this project was initiated), we continued to use the former version (with data up to 2012) because we detected in the updated version some counterintuitive adjustments for some key Latin American countries.

investment and gross domestic saving (all as shares of GDP), with the coefficient of investment constrained to be the opposite of that of saving.¹⁸ Consistent with other studies (e.g., Loayza et al, 1999), saving is derived by subtracting consumption from national income, which is equal to GDP plus net factor income and net unrequited transfers.

(b) Full sample results

Consider first the results of the OLS structural-form regressions for the full sample (i.e., not broken down by country income level), as synthesized in Table 1 (see Appendix C for the full regression results). Tables 2 and 3 complement the saving regressions for this larger sample with some OLS regressions for the smaller sample where a breakdown of saving by sector is available. Overall results indicate a good fit. Except for α , which is about twice as large under DOLS than under OLS, all other elasticities are quite similar. We will therefore only discuss the OLS results.

Starting with the ES channel, the growth elasticity of saving, α , is positive and significant (Table 1). The strength of the ES channel comes mainly from the public and (non-financial) corporate sectors (Table 2). There is however a remarkable difference between these two sectors when their saving performance is compared across countries (Table 3). The share of (non-financial) corporate saving (as well as that of foreign saving) in total domestic saving rises in countries that save less than their peers (hence where savings are relatively scarce), while that of the public sector declines. This confirms the key role corporate saving plays as the most buoyant component of domestic saving. On the one hand, corporate saving boosts aggregate saving during growth spurts, hence accounting for the bulk of the ES channel response capacity. On the other hand, it fills up the saving gaps when saving is scarce. By contrast, in the case of the public sector, when it rains it pours: its share of total saving is higher the more a country saves relative to its peers.

Turning now to the ER channel and the real exchange rate regressions, consistent with the first leg of this channel, the real exchange rate appreciates as the current account worsens ($\beta_e > 0$). However, β_e loses significance for economies experiencing current account surpluses, indicating that nonlinearities also affect the ER channel. To the extent that current account surpluses are more likely to occur under slack conditions, this is consistent with a weakening link between demand and prices as the economy drifts away from its productive frontier. There is also an important multiplier effect operating through β_s , the saving's response to the real exchange rate. In addition, as postulated under the ER channel, investment rises ($\beta_I < 0$) and growth accelerates ($\beta_g < 0$) as the exchange rate depreciates.

Moving on to the IR channel and the sovereign risk rating regressions, as postulated, ratings improve as the country's current account of the balance of payments strengthens ($\gamma_r < 0$). However, there are strong nonlinearities, as γ_r loses significance (and switches sign) for economies with current account surpluses. Thus, as expected, the IR channel becomes operative only where debt sustainability becomes an issue. Also consistent with priors under the IR channel, the real exchange rate appreciates ($\gamma_e > 0$), investment increases ($\gamma_I > 0$), and growth rises ($\gamma_g > 0$) as country risk ratings improve. Yet, the condition $\beta_e + \gamma_e \gamma_r > 0$ is always

¹⁸ Because investment and saving are expressed in logs, the difference between saving and investment (net saving) is approximated by the difference of their logarithms.

satisfied, which indicates that, *on average*, the ER channel statistically dominates the IR channel. Thus, on average, an increase in saving depreciates the real exchange rate.

(c) Results by country income level

Consider now the results by income level (Table 1). Middle-income countries (World Bank definition) generally fit the model better.¹⁹ The responsiveness of saving to growth (the ES channel) is higher in the middle-income countries than in the low-income countries and comparable to that in the high-income countries. At the same time, only low and middle-income countries show a strong ER association between real exchange rate appreciations and increases in the current account deficit. The ER links between the real exchange rate and investment, or the real exchange rate and growth are similarly stronger in the middle-income countries, and so is the IR link between current account deficits and country ratings.

Such heterogeneity at either end of the per capita income scale is not too surprising. Higher-income countries should become less susceptible to ER- or IR-type macroeconomic patterns as the frictions limiting cross-border and cross-sector factor mobility become eroded away with economic development and global integration. In other words, in richer countries, the substitutability between foreign and domestic saving is likely to be greater. Similarly, at the lower end of the per capita income distribution, the relevance of the ER and IR channels should also be limited, this time due to insufficient scale effects. In particular, it is reasonable to expect the positive growth externalities associated with the development of the tradable sector to start appearing only beyond some minimum threshold of economic size and development. Similarly, IR-type debt and crisis dynamics are likely to require a level of development of capital markets that is unlikely to be present in the lowest-income countries.

(d) Impact analysis

While the structural-form regressions support all three channels, they yield a modest estimate of their impact. A ten percentage points of GDP domestic saving mobilization effort (the effort needed to bring Latin American saving rates broadly at par with those of emerging Asia) would raise yearly per capita income growth by only 0.3 percentage point in countries with current account deficits (Table 4). About two-thirds of this impact comes from the ER channel and only one-third from the IR channel. Furthermore, consistent with the existence of strong asymmetries and nonlinearities, impacts are even smaller in the case of current account surpluses. The ES channel provides a significant but limited contribution to growth. From each dollar of additional investment, about 10 cents would be self-financed by the induced increase in savings caused by the higher growth. This falls far short of the ES-on-steroids level.

The structural-form regression estimates have severe limitations, however. They pinpoint correlations but not directions of causality, and do not account for cross-equation interrelations and simultaneity. To circumvent such limitations we run reduced-form, instrumental variable-based estimates, based on the following set of instruments:²⁰

- Domestic saving: *old dependency ratio*
- Real exchange rate: *commercial openness*

¹⁹ This is consistent with results reported in the literature (see for example Rodrik, 2008).

²⁰ To avoid spurious correlations, we first regress the instruments against GDP per capita and country size, and use the residuals, instead of the raw data.

- Country rating: *enabling environment*
- Investment: *inflation crisis dummy*
- Per capita income growth: *population growth*

Arguably, all five instruments meet the exogeneity requirement. Demographics (the old dependency ratio) determines saving but not the other way around. Commercial openness affects the real exchange rate but it is hard to argue that the real exchange rate affects total trade (even if it clearly affects the current account, hence the composition of trade between imports and exports).²¹ The enabling environment (which reflects deep historical trends and fundamental institutions) clearly matters for the country rating but it is hard to see a strong reverse causality in the medium-term. Inflation crises (i.e., high inflation episodes) have substantial effects on investor behavior and are obviously endogenous to the macroeconomic environment (monetary and fiscal policy), but the reverse link going from investment to inflation is tenuous at best. And although population growth is a function of the level of per capita income, it is improbable that population growth would move significantly with the rate of growth of per capita income.

Reflecting high endogeneity in the system, only four elasticities $\{\alpha, \beta_e, \gamma_g, \delta\}$ can be retrieved, all of which are substantially above those obtained through OLS estimates (see Appendix D).²² The sub-set $\{\beta_s, \beta_t, \beta_g, \gamma_e\}$ has p values high enough to suggest non-zero elasticities while the sub-set $\{\gamma, \gamma_r\}$ does not. Thus, setting $\gamma = \gamma_r = 0$, adopting for $\{\beta_s, \beta_t, \beta_g, \gamma_e\}$ the previously obtained structural-form OLS values, and retaining for the other four elasticities the values indicated above yields a more significant growth acceleration (0.85 percentage points per year for a ten percentage points increase in the saving to GDP ratio). Although the ES channel now makes a more significant contribution to growth, it still falls short of 100 percent. Thus, the evidence continues to lean against an ES-on-steroids view.

For current account deficits, δ and β_e are no longer identifiable. Maintaining the values obtained for current account surpluses but using for γ_r its OLS value yields a modestly higher impact (1.14 percentage points of higher growth for a 10 percentage points increase in the saving to GDP ratio). However, since OLS estimates yielded a much higher β_e (about three times larger) for current account deficits than for surpluses, this procedure is likely to underestimate the true value of β_e , hence the potential impact of a saving boost in the context of current account deficits. The same can be said for γ_r , as the structural estimates actually yielded a wrong-signed estimate for current account surpluses. Using plausibly higher (albeit admittedly somewhat speculative) values for β_e and γ_r yields a much higher range of impacts.²³

5. Exploring the macro patterns of the saving-growth channels

Based on the above estimates, this section uses the benchmarking methodology described earlier to contrast the macroeconomic patterns induced by the ER and IR channels.

²¹ See IMF (2013) for a similar interpretation.

²² The IV estimated value of 0.07 for α is very close to its DOLS estimated value (0.064). Also, the estimated value of 5.15 for δ is consistent with the range of values for key parameters (capital share, investment to GDP ratio, and capital-output ratios) reported for middle-income countries (see Appendix A).

²³ Using a twice as large value for β_e as that estimated for current account surpluses (0.86) and adopting for γ_r its OLS value for middle-income countries (-0.18) would raise the growth rate (for the same 10 percentage points increase in the saving-to-GDP ratio) by about 2.7 percentage points for countries with current account deficits.

It shows that these patterns are consistent with priors. The section concludes with a brief look at Latin America's recent macro history, which illustrates how the ER and IR patterns have interacted over time. Since we are only interested in the relative positions of countries but not in causality or policy impacts, we use the results of the more complete structural form regression system.

(a) Cross-country patterns

Figures 2-6 reveal the starkly contrasting features of the ER and IR channels. Figure 2, which interacts the real exchange rate gaps with the growth gaps, essentially reproduces the findings of Rodrik (2008), whereby countries with more competitive real exchange rate growth faster, in line with the second leg of the ER channel. In turn, Figure 3, which interacts the saving gap with the real exchange rate gap, illustrates the first leg of the ER channel. Countries that save more have more competitive real exchange rates. In addition, Figure 4 shows that countries that have more competitive exchange rates are more export oriented (they have a higher ratio of external to domestic demand). Thus, the central tendency of the entire sample bears the ER signature. Yet, as is apparent in Figures 5 and 6, there are also IR forces clearly at work. Countries that save more have higher ratings (Figure 5) and stronger current account balances (Figure 6).

The footprints of the ER and IR channels can be best identified in Figure 7, where we plot the median growth gaps, rating gaps, and investment gaps for all observations located in each of the quadrants of the same saving-exchange rate map that was displayed in Figure 3. To help distinguish the ex-ante (pre-crisis) from ex-post (post-crisis) modes of the IR channel, we also plot the median inflation rates in each of the quadrants. The results confirm the existence of very distinct ER-IR patterns aligning along each of the diagonals in the map:

- In accordance with the ER pattern, the points in the top left quadrant (the undervalued-high savers) are associated with high growth and high investment (i.e., positive gaps); instead, the observations in the bottom right quadrant (the overvalued-low savers) are associated with low growth and low investment (i.e., negative gaps). Remarkably, there is not much difference between the two groups as regard their sovereign ratings, which suggests that, as long as the low saving and overvalued exchange rates do not raise fiscal and balance of payments sustainability issues, the country ratings remain unaffected.
- In accordance with the ex-ante mode of the IR pattern, the points in the bottom left quadrant (the undervalued-low savers) are associated with low sovereign ratings (i.e., negative gaps), while those in the upper right quadrant (the overvalued-high savers) are associated with high ratings (i.e., positive gaps). The growth performance of the observations in the overvalued quadrants is substantially below benchmark while that of the observations in the bottom left quadrant (undervalued-low savers) is only slightly above benchmark. This suggests that while overvaluation typically undermines growth, a necessary condition for undervaluation not to undermine growth is macro sustainability (as signaled by positive sovereign rating gaps).
- In accordance with the ex-post pattern of the IR channel, inflation is the highest in the bottom left quadrant (undervalued-low savers). High inflation countries are

typically the ones under the spell of financial repression and flight capital, which is a trademark of macroeconomic and financial crises.

(b) The case of Latin America

We now use the benchmarking framework to locate and contrast the macroeconomic paths followed over the last three decades by the Latin America and the Caribbean (LAC) region, particularly by its larger, middle-income countries.²⁴ When countries are divided according to their average saving and real exchange rate gaps over the period 1990-2012, it is first worth noting that LAC is the only region deep inside the bottom left quadrants of both Figures 3 and 5. *On average*, LAC has conformed to an IR pattern of low saving, low rating and undervaluation. Moreover, the region saving rate was low not just because LAC's growth rate was low (i.e., only a reflection of the ES channel). As shown in Figure 8, LAC's average saving rate was persistently below benchmark, whether calculated on the basis of the benchmark growth rate or the actual growth rate.

Yet, the above averages hide substantial diversity, both across countries and over time. For simplicity, let us consider only the larger middle-income countries in LAC (henceforth, the LAC1 countries). Looking first across countries, four groups of LAC1 countries stand out (Figure 9). The first group (Chile, Mexico Panama and Peru) occupies the top left quadrant. These are countries with positive saving gaps and undervalued real exchange rates that conform to what one would expect for high savers under the ER channel. On the polar opposite side of Figure 9 (the bottom right quadrant) stands another group (Brazil, Costa Rica, and Uruguay) that also conforms to the ER channel but on the low saving side. Exchange rates were overvalued because saving was low. The four remaining countries can in turn be assembled into two IR groups. The group in the bottom left quadrant (Colombia and Ecuador) conforms to an *ex ante* IR pattern of low savings yet undervalued exchange rates. Instead, the group sitting in the top left quadrant (Argentina and Venezuela) conforms to an *ex post* IR pattern of high savings and appreciated exchange rates, where financial repression and exclusion from world capital markets forced private saving upward.

Let us now focus, with the help of Figure 10, on the two groups of LAC1 countries that followed the ER pattern in Figure 9. The contrast between these two groups is obvious in term of their saving gaps (Figure 10.d): the high savers significantly exceeded their benchmarks throughout the entire period while the low savers fell short by a wide margin, especially during the 1990s, the stabilization years. Consider now the real exchange rates gaps (Figure 10.a). Both groups started from deeply under-valued currencies in the crisis-laden 1980s and subsequently appreciated, but the appreciation was much more pronounced in the case of the low savers, with the real exchange rate plateauing in the case of the high-savers while the low savers continued to appreciate over the whole period. Such stark end-of-period difference is difficult to explain based on IR-based pressures. Indeed, following an major initial dip characteristic of the 1980s, sovereign ratings rose steadily and ended up over-performing for both groups (Figure 10.b). The evidence therefore suggests it was the ER channel, rather than the IR channel, that was mostly responsible for the distinct paths followed by the real exchange rate in these two groups of countries. As a result, the low savers experienced much higher current account deficits, and ended up paying a much heavier price in terms of lower investment and growth rates (Figures 10 f, e and c, respectively).

²⁴ We only include LAC countries with per capita income above \$5,000 a year.

The data also suggest the presence of interaction and sequencing effects that reflect the relative dominance of the ER and IR channels. This can best be appreciated in Figure 11, which plots the path followed by the correlation between the saving and real exchange rate gaps during 1981-2015.²⁵ During the 1980s, the correlation was mostly positive and rising, pointing toward a clear IR dominance under the pull of widespread balance of payments crises. Instead, during the 1990s, the correlation trended downward as the region's macroeconomic policies improved, suggesting a switch from IR to ER-dominated dynamics. The downward trend continued during the 2000s, as saving rates declined and real exchange rates appreciated further under the pull of the commodities boom. Thus, by 2011-12, LAC1 countries aligned closely along the second diagonal, as predicted by an ER-dominated pattern (Figure 12). Yet, a new reversal of the trend, back in the IR direction, took place in 2012 after the commodities boom peaked and real exchange rates started again to depreciate.

The above patterns therefore suggest some systematic dynamic interaction between the IR and ER channels, with one channel feeding the other. The decline in saving, real appreciation and increase in foreign liabilities brought about by the ER channel sowed the seeds for subsequent IR dynamics when the ER path became unsustainable. In turn, the real depreciation and domestic saving adjustment brought about by the IR channel as economies lost access to foreign saving set the ground for a new round of ER-driven appreciation.

Importantly, however, domestic or external macroeconomic events (such as large terms of trade shock associated with commodity cycle) triggered or accentuated these dynamics. This in turn is consistent with the potentially persistent yet ultimately transient nature of the ER channel. As argued in Section 3, a stable link between saving and the real exchange rate should naturally emerge and persist in a stochastic world where production factors adjust sluggishly and that is constantly buffeted by exogenous shocks to which countries must respond by adjusting their saving rate. Thus, in the recent commodities cycle, Latin American countries had to choose how much of the windfalls to save. As predicted by the ER channel, countries saving more experienced more moderate appreciations and better growth.

6. Concluding thoughts

Despite the clear limitations of this paper (further work is needed to refine the reduced-form estimates, which at present rely on only a limited subset of elasticities; and a dynamic framework is clearly required to fully account for the complex stochastic interactions between the IR and ER channels), its main messages and results are worthy of attention. They point toward two complementary directions for policy.

First, there is an important role for short-term oriented policy in avoiding saving collapses (consumption exuberance) in countries undergoing regime changes or exposed to external shocks, such as surges of capital inflows or booms in commodity prices. From an ER perspective, a surge in capital inflows is either an external response to a domestic saving shock or call for a domestic saving response to an external shock. Thus, capital controls on inflows would arguably be a suitable response if the inflows are originated externally, whereas macro-prudential policy would better suit a situation where the inflows are triggered by a domestic

²⁵ Yearly gaps were calculated for LAC1 countries until 2015 using an expanded database. Time fixed effects were estimated using the residuals of the structural form regression for the real exchange rate.

saving shock. In the case of surges in commodity prices, countries should save as much as possible of the windfall gains when the latter are temporary.²⁶

Second, precautionary saving mobilization efforts may be a justifiable insurance policy in middle-income countries with structurally low domestic saving rates, hence with a tendency to overheat more quickly and go more readily into balance of payments deficits as domestic demand pressures build up. Reflecting the strong non-linearity of elasticities (hence impacts), structural saving mobilization efforts can help countries stay clear from the region where the *marginal* impacts of demand shocks on the real exchange rate and the risk premium are higher, thereby reducing demand-induced macroeconomic instability. Thus, during upturns, by reducing the real exchange rate appreciation resulting from demand pressures, saving mobilization efforts can limit the potential damage associated with extreme ER-led trajectories. During downturns, by improving the structural balance of payments, such efforts can provide the policy space needed to moderate the adverse growth implications of abrupt reversals into IR-led trajectories.²⁷

²⁶ Because benchmarks and gaps are controlled for changes in terms of trade, spending (instead of saving) a windfall gain derived from a favorable terms of trade shock worsens a country's saving gap.

²⁷ Such a policy approach should be immune to fallacies of composition whereby saving efforts by individual countries lower world demand and weaken world growth. That is because collectively inefficient world saving gluts are unlikely to arise as long as countries' policy objective is limited to avoiding large and chronic current account deficits, rather than further raising already positive current accounts.

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TABLES AND FIGURES

Table 1. Summary Regression Results

	OLS Full Sample	DOLS Full Sample	Low Income	OLS Middle Income	High Income	IV Full Sample
<u>Elasticities</u>						
α	0.0251**	0.0636*	0.00960	0.0314**	0.0380**	0.07**
$\beta_e (CA>0)$	0.0414	0.0455	0.190***	0.0717+	-0.0402	0.43+
$\beta_e (CA<0)$	0.138***	0.130***	0.0609+	0.0845**	0.0728+	
β_s	-0.324**	-0.343**	-1.016**	-0.247+	-0.0232	
β_I	-0.357***	-0.228***	0.133	-0.301***	0.0115	
β_g	-1.846***	-1.324***	-0.180	-1.836***	-1.440+	
$\gamma_r (CA>0)$	0.0733	0.0739	0.112***	0.0541	0.118+	
$\gamma_r (CA<0)$	-0.102***	-0.0978**	-0.00433	-0.178***	-0.112***	
γ_e	0.208***	0.185***	0.136	0.146***	0.241***	
γ_I	0.263***	0.148**	0.290+	0.270***	0.154	
γ_g	1.117***	2.082***	0.872	0.984**	2.018+	4.96**
δ	3.181***	2.184***	2.257*	3.379***	1.555**	5.15*
<u>Critical Conditions</u>						
$\beta_e + \gamma_e \gamma_r (CA>0)$	0.0566	0.0592	0.205***	0.0796	-0.0119	0.43+
$\beta_e + \gamma_e \gamma_r (CA<0)$	0.117***	0.112***	0.0603+	0.0584**	0.0457	
$\alpha\delta$	0.0799**	0.139*	0.0217	0.106**	0.0590+	0.3605+

*** p<0.01, ** p<0.05, * p<0.1, + p<0.2

Notes: Statistical significance is reported for country clustering. The standard deviations for the IV estimation are calculated using the suest and nlcom Stata routines on the direct ratios. The same routines are used for the standard deviations of the critical conditions.

Table 2. Sectorial Saving Regressions

	(1) FinCorp	(2) NonFinCorp	(3) Households	(4) Government	(5) DomSavings	(6) ForSavings
LGDPPc	0.34***	-0.13	-1.09*	1.82***	0.93	-3.04***
GDPpcGrowth	0.080***	0.25***	0.17	0.41***	0.75***	-0.15
PopGrowth	-0.40***	-2.47***	0.46	0.28	-2.13**	-1.15*
FuelExp	0.018*	0.16***	-0.31***	0.21***	0.074	-0.28***
OldDepend	0.065***	-0.075	-0.046	-0.21***	-0.40***	0.11
Constant	0.13	14.6***	17.7***	-12.7***	19.7***	30.3***
Observations	263	263	263	263	263	263
R-squared	0.108	0.385	0.154	0.293	0.172	0.256

*** p<0.01, ** p<0.05, * p<0.1

Source: UN National Accounts Main Aggregates database.

Notes: Output growth is a very significant determinant of corporate savings and government savings (hence of domestic savings as a whole), yet not of household savings, which suggests that (non-financial) corporate and public savings are the main factors underlying the growth elasticity of domestic savings.

Table 3. Sectorial Saving Shares vs. Domestic Saving Gap

	(1)	(2)	(3)	(4)	(5)	(6)
	FinCorp	NonFinCorp	Households	Government	DomSavings	ForSavings
DomSavings Gap	-3.81***	-13.1***	2.95	17.2***	3.25	-42.3***
Constant	0.25	0.86	-0.19	-1.13	-0.21	2.78
Observations	263	263	263	263	263	263
R-squared	0.043	0.037	0.001	0.097	0.003	0.164
r2_a	0.0394	0.0333	-0.00247	0.0933	-0.000519	0.161

*** p<0.01, ** p<0.05, * p<0.1

Source: UN National Accounts Main Aggregates database.

Notes: The domestic saving gap is that obtained from the benchmarking exercise described in Section 3. The saving shares are the sectorial savings divided by total domestic savings.

Table 4. Impacts

	OLS		DOLS		IV	
	CA>0	CA<0	CA<0	CA>0	CA<0	CA<0*
<u>Elasticities</u>						
α	0.0251	0.0251	0.0636	0.07	0.07	0.07
β_e	0.0414	0.138	0.130	0.43	0.43	0.86
β_s	-0.324	-0.324	-0.343	-0.38	-0.38	-0.38
β_I	-0.357	-0.357	-0.228	-0.32	-0.32	-0.32
β_g	-1.846	-1.846	-1.324	-1.8	-1.8	-1.8
γ_r	0.0733	-0.102	-0.0978	0	-0.1	-0.18
γ_e	0.208	0.208	0.185	0.2	0.2	0.2
γ_I	0.263	0.263	0.148	0	0	0
γ_g	1.117	1.117	2.082	4.96	4.96	4.96
δ	3.181	3.181	2.184	5.15	5.15	5.15
<u>Impacts</u>						
β_I	0.02	0.06	0.03	0.31	0.29	0.53
β_g	0.04	0.10	0.07	0.34	0.32	0.58
γ_g	0	0.05	0.10	0	0.22	0.35
γ_I	0	0.04	0.02	0	0	0
β_s	0	0.01	0.01	0.11	0.15	0.51
α	0	0	0.01	0.09	0.16	0.74
TOTAL	0.06	0.28	0.23	0.85	1.14	2.71

Notes: Impact measures the growth response (in percentage points) to a 10 percent of GDP increase in the saving ratio. The elasticities and impacts shown are for the full sample. *: based on alternative values for β_e , γ_r and δ .

Figure 1. Channels Linking Saving and Growth

Note: blue arrows represent the *real exchange rate (ER) channel*; red arrows the *real interest rate (IR) channel*; and green arrows the *endogenous saving (ES) channel*.

**Figure 2. Real Exchange Rate and Growth Gaps
1990-2012**

◆ LAC 1990-2012 Average ● Other countries per Period ◆ Other groups of countries 1990-2012 Average

Sources: Authors' calculations based on UN, WDI and Institutional Investor data.

Notes: This figure shows the real exchange rate and GDP per capita growth gaps for the whole sample. Each period is a three-year average. See Section 3 for the details of how the benchmarks are calculated.

**Figure 3. Saving and Real Exchange Rate Gaps
1990-2012**

Sources: Authors' calculations based on UN, WDI and Institutional Investor data.

Notes: This figure shows the national saving and real exchange rate gaps for the whole sample. Each period is a three-year average. See Section 3 for the details of how the benchmarks are calculated.

**Figure 4. Real Exchange Rate Gap and Demand Composition
1990-2012**

◆ LAC 1990-2012 Average ● Other countries per Period ◆ Other groups of countries 1990-2012 Average

Sources: Authors' calculations based on UN, WDI and Institutional Investor data.

Notes: This figure shows the real exchange rate gaps and the demand composition for the middle income countries in the sample (World Bank classification). Demand Composition is the ratio of external demand (exports) to internal demand (consumption plus investment). Each period is a three-year average. See Section 3 for the details of how the benchmarks are calculated.

**Figure 5. Saving and Country Rating Gaps
1990-2012**

◆ LAC 1990-2012 Average ● Other countries per Period ◆ Other groups of countries 1990-2012 Average

Sources: Authors' calculations based on UN, WDI and Institutional Investor data.

Notes: This figure shows the national saving and country rating gaps for the whole sample. Each period is a three-year average. See Section 3 for the details of how the benchmarks are calculated.

**Figure 6. Saving and Current Account Gaps
1990-2012**

◆ LAC 1990-2012 Average ● Other countries per Period ◆ Other groups of countries 1990-2012 Average

Sources: Authors' calculations based on UN, WDI and Institutional Investor data.

Notes: This figure shows the national saving and current account gaps for the whole sample. Each period is a three-year average. See Section 3 for the details of how the benchmarks are calculated.

Figure 7. Saving and Real Exchange Rate Gaps, Median Inflation and Median Rating, Growth, and Investment Gaps by Quadrant 1990-2012

Sources: Authors' calculations based on UN, WDI and Institutional Investor data.

Notes: This figure is based on Figure 3. It shows the median country rating gap, GDP per capita growth gap, investment gap and inflation rate for all the observations in each quadrant for the 1990-2012 period for the whole sample.

**Figure 8. Saving in Latin America: Actual and Benchmarks
1990-2012**

Sources: Authors' calculations based on UN, WDI and Institutional Investor data.

Notes: Sample includes Bolivia, Brazil, Chile, Colombia, Costa Rica, Dominican Republic, El Salvador, Guatemala, Mexico, Peru, and Uruguay. Equilibrium (observed) benchmarks are derived from the predicted values of the saving regression based on the equilibrium (observed) values of the rate of growth and real exchange rate. See Section 3 for more details on how the benchmarks are calculated.

**Figure 9. Average Saving and Real Exchange Rate Gaps in LAC1 Countries
1990–2012**

Sources: Authors' calculations based on UN, WDI and Institutional Investor data.

Notes: This figure shows the average national saving and real exchange gaps for LAC1 countries for the 1990–2012 period. See Section 3 for the details of how the benchmarks are calculated. The dashed line is the linear fit for the per-period version of the whole sample for 1990–2012.

Figure 10. Macroeconomic Gaps for ER High-Saving and Low-Saving LAC1 Countries 1981–2012

Sources: Authors' calculations based on UN, WDI and Institutional Investor data.

Notes: This figure shows the within group average policy-adjusted gaps for different variables for the high and low saving LAC1 countries for 1980-2012: real exchange rate (Panel A), country rating (Panel B), GDP per capita growth (Panel C), national saving (Panel D), investment (Panel E) and current account (Panel F). Each period is a three-year average. See Table B1 for the groups' composition and Section 3 for the details of how the benchmarks are calculated.

Figure 11. Correlation Between the Saving and Real Exchange Rate Gaps for LAC1 Countries, 1981-2015

Sources: Authors' calculations based on UN, WDI and Institutional Investor data.

Notes: Sample includes Brazil, Chile, Colombia, Costa Rica, Ecuador, Mexico, Panama, Peru, and Uruguay.

**Figure 12. Saving and Real Exchange Rate Gaps in LAC1 Countries
2011-2012**

Sources: Authors' calculations based on UN, WDI and Institutional Investor data.

Notes: This figure shows the national saving and real exchange gaps for LAC1 countries for the 2011-2012 period, except for the data identified with a star: Argentina is 2005-2007 and Panama is 2008-2010. See Section 3 for the details of how the benchmarks are calculated. The dashed line is the linear fit for the per-period version of the whole sample for 1990-2012.

APPENDIX A

The Saving and Growth Model

1. The growth equation

Consider a single sector Cobb-Douglas productive sector, such that per capita output, y , equals:

$$y = \frac{Y}{L} = A \left[\frac{K}{L} \right]^\alpha$$

Or, in rates of growth:

$$g = \frac{\dot{y}}{y} = \frac{\dot{A}}{A} + \alpha \left(\frac{\dot{K}}{K} - \frac{\dot{L}}{L} \right)$$

Since:

$$\frac{\dot{K}}{K} = \frac{I - \delta K}{K} = \frac{I}{Y} \frac{Y}{K} - \delta$$

It follows that:

$$g = \frac{\dot{A}}{A} - \alpha \frac{\dot{L}}{L} - \alpha \delta + \alpha \frac{Y}{K} \frac{I}{Y}$$

Assuming a constant cross-sample average capital output ratio and making productivity growth a function of the level of economic development, the exchange rate gap and the rating gap, leads to a reduced-form growth equation such as equation (10) in the text. Since the investment ratio is expressed in logs, and defining the average investment to GDP percentage ratio as i^* this implies a value of δ such that:

$$\delta = \frac{\alpha i^*}{K/Y}$$

Using for middle-income countries a capital share of 0.4, an average investment to GDP ratio of 25, and an average capital-output ratio of 2 yields a δ of 5.

2. Forward model solution

Through straightforward algebraic manipulation, the cells of $(I-Q)^{-1}$ in (18) can be expressed as in Table A1:

Table A1. Forward Model Solution

	S	i	E	r	g
s	$1-Z_s$	uZ_s	$\beta_3 + \beta_2 Z_s$	$\gamma_3 + \gamma_2 Z_s$	$\alpha(1-Z_s)$
i	$-Z_i$	$1+uZ_i$	$\beta_i + \beta_2 Z_i$	$\gamma_4 + \gamma_2 Z_i$	$-\alpha Z_i$
e	$-Z_e$	uZ_e	$1 + \beta_2 Z_e$	$\gamma_e + \gamma_2 Z_e$	$-\alpha Z_e$
r	$-Z_r$	uZ_r	$\beta_2 Z_r$	$1 + \gamma_2 Z_r$	$-\alpha Z_r$
g	$-Z_g$	$\delta + uZ_g$	$\beta_1 + \beta_2 Z_g$	$\gamma_1 + \gamma_2 Z_g$	$1 - \alpha Z_g$

Where:

$$\begin{aligned}
 \beta_1 &= \beta_g + \delta\beta_i & Z_g &= A / \Delta \\
 \beta_2 &= \beta_i - \beta_s - \alpha\beta_1 & Z_s &= (\beta_s \nu + \alpha A) / \Delta \\
 \beta_3 &= \beta_s + \alpha\beta_1 & Z_i &= (\beta_i \nu + \gamma_i \gamma_r) / \Delta \\
 \gamma_1 &= \gamma_g + \beta_g \gamma_e + \delta\gamma_4 & Z_e &= \nu / \Delta \\
 \gamma_2 &= u\gamma_4 - \beta_s \gamma_e - \alpha(\gamma_g + \gamma_e \beta_g) & Z_r &= \gamma_r / \Delta \\
 \gamma_3 &= \alpha\gamma_1 + \beta_s \gamma_e & A &= \nu\beta_1 + \gamma_r \gamma_s \\
 \gamma_4 &= \gamma_i + \beta_i \gamma_e & \Delta &= 1 + \alpha A - \beta_e(\beta_i - \beta_s) \\
 \gamma_5 &= \gamma_g + \delta\gamma_i & \Delta' &= \Delta - \alpha A \\
 \nu &= \beta_e + \gamma_e \gamma_r & u &= 1 - \alpha\delta
 \end{aligned}$$

3. Backward model solution using instrumental variables

Separating the matrix of exogenous elasticities, R , into two components, one (V) related to the controls used as instruments, $\bar{Y}_t^k$ and the other (V') to the rest of the controls, equation (18) in the text can be rewritten as:

$$\hat{X}_t^k = (I-Q)^{-1} [V\bar{Y}_t^k + (V' + SR')Y_t^k] \quad (A1)$$

Writing the reduced-form estimates as:

$$\hat{X}_t^k = A\bar{Y}_t^k + BY_t^k \quad (A2)$$

It immediately follows that:

$$(I - Q)^{-1}V = A \quad (A3)$$

We include in V all significant non-diagonal structural-form instrumental coefficients and solve (A3) using the significant reduced-form instrumental coefficients in A . For an elasticity to be retrievable (i.e., to ensure that the elasticity measures the effect of the endogenous variable rather than that of its instrument)), its reduced-form instrumental coefficient should be significant and the number of significant reduced-form instrumental coefficients in the matrix row corresponding to this elasticity should exceed the number of significant structural-form instrumental coefficients by at least the number of elasticities to be determined in that row (see Tables A2 and A3).²⁸

Table A2. Instrumental Coefficients, Structural and Reduced Forms

	SAV		INV		REER		RAT		GRO	
	v	a	v	a	v	a	v	a	v	a
r_OldDepend CA<0	-0.0186**	-0.0201**	-0.00480	0.00156	-0.00407	-0.00286	-0.00103	-0.000962	-0.0354	-0.0294
r_OldDepend CA>0	-0.0232**	-0.0301***	-0.000740	-8.26e-05	0.00303	0.00592	-0.00225	-0.00289	0.0388	0.0663*
r_Inflation CA<0	-0.106	0.0364	-0.207**	-0.118+	-0.194**	-0.287***	-0.164**	-0.240***	-0.327	-0.689+
r_Inflation CA>0	0.0596	0.224*	-0.249*	-0.143+	-0.0216	-0.127*	-0.0954	-0.0851	-0.836+	-1.478***
r_LTradOpen	0.222***	0.288***	0.0780*	0.124***	-0.153***	-0.168***	0.0439	0.0517+	0.802**	1.119***
r_EnabEnv	0.0820	0.0521	-0.0535	-0.00481	0.0837**	0.0701*	0.201***	0.167***	-0.0372	0.586**
r_PopGrowth	-0.0442	-0.104**	-0.0141	-0.0145	0.0778***	0.0773***	0.0160	-0.00250	-0.873***	-1.095***

*** p<0.01, ** p<0.05, * p<0.1, + p<0.2

Notes: The coefficients in the columns entitled 'v' correspond to the structural forms, and those under the columns entitled 'a' correspond to the reduced forms.

²⁸ To ensure that we do not unduly discard structural-form instrumental coefficients, we adopt a high (20%) significance threshold.

Table A3. Instrumental Coefficients and Reduced Form Elasticities²⁹

	SAV	INV	RER	RAT	GRO
r_OldDepend			β'_e	γ'_r	
r_Inflation			β_e	γ_r	δ
r_LTradOpen		β_I			β_g
r_EnabEnv		γ_I			γ_g
r_PopGrowth	α				

Notes: This table shows which of the coefficients in the previous table were used to calculate each of the reduced form elasticities.

The following four retrievable elasticities are thereby obtained:

$$\alpha = \frac{a_s^g - \beta_s a_e^g}{a_g^g}$$

$$\gamma_g = \frac{a_g^r - \beta_1 a_e^r}{a_r^r}$$

$$\delta = \frac{\Delta}{\alpha[1 + \beta_e \beta_i + \eta(a_i^i - \alpha \beta_e \beta_i a_g^i)]}$$

$$\eta = \frac{\beta_e}{1 + \beta_e \beta_s} \frac{1}{(a_i^i - a_s^i) \beta_e - a_e^i}$$

$$\beta_e = \frac{a_e^i}{a_i^i - a_s^i} \frac{1}{1 - \varepsilon(a_i^i - \beta_i a_s^i)}$$

$$\varepsilon = \frac{\alpha \delta}{1 + \beta_e(\beta_s - \beta_i + \alpha \beta_1)}$$

²⁹ Since the current account equals investment minus saving, β_e and γ_r can be retrieved from the investment side or the saving side.

Appendix B

Statistical Appendix

Table B1. Country Group Composition

Region	Countries
LAC 1	Argentina, Bahamas, Barbados, Brazil, Chile, Colombia, Costa Rica, Ecuador, Mexico, Panama, Peru, Trinidad, Uruguay, República Bolivariana de Venezuela.
LAC 2	Belize, Bolivia, Dominican Republic, El Salvador, Guatemala, Guyana, Honduras, Nicaragua, Paraguay.
EAP	Bangladesh, Bhutan, Cambodia, China, Fiji, Hong Kong SAR, China, India, Indonesia, Korea, Rep., Malaysia, Pakistan, Papua New Guinea, Philippines, Sri Lanka, Thailand, Tonga, Vietnam.
ECA	Albania, Armenia, Azerbaijan, Belarus, Bosnia and Herzegovina, Bulgaria, Croatia, Czech Republic, Estonia, Georgia, Greece, Hungary, Kazakhstan, Kyrgyz Republic, Latvia, Lithuania, Macedonia, Moldova, Mongolia, Romania, Slovenia, Tajikistan, Turkmenistan, Ukraine.
High Income	Australia, Belgium, Canada, Cyprus, Denmark, Finland, France, Germany, Iceland, Ireland, Israel, Italy, Japan, New Zealand, Norway, Portugal, Spain, Sweden, Switzerland, United Kingdom, United States.
MNA	Algeria, Iran: Islamic Rep., Jordan, Lebanon, Morocco, Syrian Arab Republic, Tunisia, Turkey.
SSA	Angola, Benin, Botswana, Burkina Faso, Burundi, Cameroon, Chad, Côte d' Ivoire, Equatorial Guinea, Ethiopia, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Kenya, Lesotho, Madagascar, Malawi, Mali, Mauritania, Mauritius, Mozambique, Namibia, Niger, Rwanda, Senegal, South Africa, Sudan, Swaziland, Togo, Uganda, Zambia.

Table B2. Data Definitions and Sources

Variable	Description	Source
LDomSavings	Domestic saving as a share of GDP. Expressed in logs . Domestic saving is gross national disposable income (GDP plus net factor income and net unrequited transfers). Gross Savings/GDP from UN; net factor payments/GDP and net unrequited transfers/GDP from WDI.	UN data and World Development Indicators
LInvestment	Investment as a share of GDP. Expressed in logs.	UN data
LRating	Country risk rating. Expressed in logs.	Institutional Investor database
GDPpGrowth	Per capita income growth rate.	World Development Indicators
LExcRate	Ratio of the purchasing power parity conversion factor to the nominal exchange rate with respect to the US dollar. The series used is the one which was available before the mid 2014 update. Expressed in logs.	World Development Indicators
LInv-LSav	Current Account calculated as the difference between investment and domestic saving. Expressed in logs	UN data and World Development Indicators
LGDPpc	Per capita income. Expressed in logs.	World Development Indicators
OldDepend	Ratio of old in the work population to total work population.	World Development Indicators
Population	Total population.	World Development Indicators
PopGrowth	Rate of population growth.	World Development Indicators
FuelExp	Oil exports as a share of GDP. Fuel Exports from WDI with missing data filled through linear prediction using WB Wealth of Nations data.	World Development Indicators and Wealth of Nations
TradOpen	Ratio of imports plus exports to GDP. Expressed in logs.	World Development Indicators
CapOpen	Capital openness index	Chinn and Ito (2006)
Transf	Net unrequited transfers as a share of GDP.	World Development Indicators
LPubCons	Public consumption as a share of GDP. Expressed in logs.	World Development Indicators
FiscBal	Fiscal balance as a share of GDP.	The Economist Countries Profiles
EnabEnv	Simple average of the Corruption and Rule of Law Indexes.	World Governance Indicators
Inflation	Inflation crisis dummy.	Reinhart and Rogoff (2011)
ExtDebt	External debt crisis dummy.	Reinhart and Rogoff (2011)
RiskAv	Risk Appetite-Safe Haven: calculated as the VIX times a safe haven dummy that is equal to one for the U.S., Japan and Switzerland, and zero for the rest of the countries. VIX data extrapolated backwards using the S&P-500 index.	VIX and S&P-500
ToT	Terms of trades expressed in logs. Missing data from WDI completed through smooth pasting with IFS data.	World Development Indicators and International Financial Statistics
FinCorp	Savings of the financial corporate sector divided by total domestic savings	UN National Accounts Main Aggregates database.
NonFinCorp	Savings of the non-financial corporate sector divided by total domestic savings	UN National Accounts Main Aggregates database.
Households	Household savings divided by total domestic savings	UN National Accounts Main Aggregates database.
Government	Government savings divided by total domestic savings	UN National Accounts Main Aggregates database.
ForSavings	Savings of the foreign sector divided by total domestic savings	UN National Accounts Main Aggregates database.

Table B3. Data Statistics

Variable	Mean	Standard Deviation	Minimum	Maximum
DomSaving	21.03	11.25	-16.60	80.96
Investment	23.01	7.40	4.74	67.88
GDPpcGrowth	2.53	3.58	-8.00	36.30
ExcRate	61.60	29.33	18.71	175.42
GDPpc	11103.03	11162.58	272.22	48352.78
OldDepend	12.08	7.34	4.30	38.27
PopGrowth	1.49	1.12	-1.71	6.95
FuelExp	5.13	13.45	0.00	150.64
ToT	4.63	0.23	3.33	5.56
TradOpen	0.78	0.46	0.09	4.47
CapOpen	0.39	1.58	-1.86	2.44
Transf	3.74	6.00	-3.52	44.87
PubCons	15.11	5.56	2.89	38.01
FiscBal	-2.33	3.97	-23.39	23.69
PrivCre	53.36	48.85	1.25	276.25
Rating	45.90	25.07	8.20	97.23
FinCorp	1.22	6.17	-29.73	19.18
NonFinCorp	1.69	1.16	-2.14	7.02
Households	11.37	4.48	-0.18	27.81
Government	6.31	7.05	-18.16	29.74
ForSavings	1.22	6.17	-29.73	19.18
Population	5.20e+07	1.60e+08	99697.67	1.35e+09
EnabEnv	0.13	1.02	-1.53	2.23
Inflation	0.08	0.24	0	1
ExtDebt	0.18	0.35	0	1
RiskAv	0.49	3.11	0	26.48

Appendix C

Full Regression Results

Table C1. Structural Saving Regressions³⁰

	Full Sample	Full Sample	Low Income	Middle Income	High Income
	(1)	(2)	(3)	(4)	(5)
	OLS	DOLS	OLS	OLS	OLS
GDPpcGrowth	0.0251**	0.0636*	0.00960	0.0314**	0.0380**
LExcRate	-0.324**	-0.343**	-1.016**	-0.247+	-0.0232
LGDPpc	0.340***	0.356***	0.739***	0.170**	0.294
Fuel Exp	0.0157***	0.0160***	0.00626	0.0163***	0.0210*
OldDepend	-0.0214***	-0.0289***	-0.0418	-0.0361***	-0.000596
PopGrowth	-0.0544	-0.0876*	0.227+	-0.117+	0.00225
FiscBal	0.0201***	0.0211***	-0.0194	0.0183*	0.0104+
Transf	-0.000544	-0.00291	0.0150	-0.00824	-0.0375
ToT	-0.300*	-0.417**	-0.00339	-0.403**	-0.520**
Constant	1.278	1.876+	-4.580**	3.614***	2.151
Observations	780	1,804	117	471	192
R-squared	0.336	0.354	0.270	0.278	0.424
r2_a	0.319	0.333	0.127	0.248	0.360

*** p<0.01, ** p<0.05, * p<0.1, + p<0.2

Notes: Statistical significance is reported for country clustering.

³⁰ The negative sign of the terms of trade reflects the fact that each component of aggregate demand (GDP) is deflated by its own deflator. As the current account is calculated based on “real” exports and imports, national incomes do not reflect the gains and losses caused by terms of trade changes. Instead, saving falls as consumption tends to rise following terms of trade gains.

Table C2. Structural Real Exchange Rate Regressions

	Full Sample	Full Sample	Low Income	Middle Income	High Income
	(1)	(2)	(3)	(4)	(5)
	OLS	DOLS	OLS	OLS	OLS
LRInv-LRSav CA>0	0.0414	0.0455	0.190***	0.0717+	-0.0402
LRInv-LRSav CA<0	0.138***	0.130***	0.0609+	0.0845**	0.0728+
LRRating	0.208***	0.185***	0.136	0.146***	0.241***
LRGDPpc	0.186***	0.191***	0.149+	0.145***	0.412***
LRTotT	0.385	0.746*	0.221	0.681**	0.667*
LRTradOpen	-0.0974***	-0.0846**	-0.0356	-0.0573	0.0651
RiskAv	0.00972+	0.00896+			0.0107**
Inflation	-0.181***	-0.193***	-0.00594	-0.124*	0.00275
RCapOpen	0.000402+	0.000595**	-0.00178**	0.000419+	-0.000531+
LRPubCons	0.130***	0.128***	-0.0690	0.0639	0.353***
Constant	0.0471	-0.0559	-0.155	-0.177**	0.145+
Observations	807	2,287	123	491	193
R-squared	0.734	0.721	0.546	0.519	0.721
r2_a	0.727	0.714	0.462	0.499	0.688

*** p<0.01, ** p<0.05, * p<0.1, + p<0.2

Notes: Statistical significance is reported for country clustering.

Table C3. Structural Investment Regressions

	Full Sample	Full Sample	Low Income	Middle Income	High Income
	(1)	(2)	(3)	(4)	(5)
	OLS	DOLS	OLS	OLS	OLS
LExcRate	-0.357***	-0.228***	0.133	-0.301***	0.0115
LRating	0.263***	0.148**	0.290+	0.270***	0.154
LGDPpc	0.00219	0.0196	0.0177	-0.0114	-0.0537
Inflation	-0.218***	-0.158**	-0.555***	-0.180***	-0.00969
Constant	1.997***	2.191***	2.332***	2.159***	2.819**
Observations	813	2,877	128	492	193
R-squared	0.195	0.171	0.473	0.181	0.184
r2_a	0.181	0.159	0.408	0.157	0.120

*** p<0.01, ** p<0.05, * p<0.1, + p<0.2

Notes: Statistical significance is reported for country clustering.

Table C4. Structural Growth Regressions

	Full Sample	Full Sample	Low Income	Middle Income	High Income
	(1)	(2)	(3)	(4)	(5)
	OLS	DOLS	OLS	OLS	OLS
LInvestment	3.181***	2.184***	2.257*	3.379***	1.555**
LExcRate	-1.846***	-1.324***	-0.180	-1.836***	-1.440+
LRating	1.117***	2.082***	0.872	0.984**	2.018+
LGDPpc	-0.671***	-0.821***	-0.833	-0.389	1.131+
PopGrowth	-0.849***	-0.500***	-1.221**	-0.831***	0.0926
Constant	-5.514**	-4.493**	1.990	-8.041*	-25.00***
Observations	813	2,857	128	492	193
R-squared	0.340	0.361	0.244	0.360	0.576
r2_a	0.327	0.352	0.143	0.340	0.540

*** p<0.01, ** p<0.05, * p<0.1, + p<0.2

Notes: Statistical significance is reported for country clustering.

Table C5. Structural Country Rating Regressions

	Full Sample	Full Sample	Low Income	Middle Income	High Income
	(1)	(2)	(3)	(4)	(5)
	OLS	DOLS	OLS	OLS	OLS
LInv-LSav CA>0	0.0733	0.0739	0.112***	0.0541	0.118+
LInv-LSav CA<0	-0.102***	-0.0978**	-0.00433	-0.178***	-0.112***
LGDPpc	0.192***	0.197***	0.159*	0.234***	0.182**
CapOpen	0.0308***	0.0382***	0.0181	0.0283*	0.0675***
TradOpen	-0.0382+	-0.0295	0.150	-0.0551+	-0.0625
LPubCons	0.00782	0.0490	0.0871	0.0246	0.0588
FiscBal	0.00393	0.00464	0.00374	0.00536	0.00412+
Inflation	-0.118**	-0.129**	-0.168	-0.100+	-0.215*
ExtDebt	-0.395***	-0.400***	-0.366***	-0.413***	-1.917***
EnabEnv	0.193***	0.181***	0.162**	0.218***	0.0809**
Population	5.70e-10***	4.92e-10***	2.20e-09***	5.61e-10***	4.75e-10+
Constant	2.071***	1.975***	1.822**	1.743***	2.030**
Observations	807	2,207	123	491	193
R-squared	0.884	0.875	0.753	0.776	0.796
r2_a	0.881	0.872	0.702	0.766	0.771

*** p<0.01, ** p<0.05, * p<0.1, + p<0.2

Notes: Statistical significance is reported for country clustering.