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Firm Productivity as an Engine of Saving

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Abstract*

This technical note considers whether low savings in Latin America and the Caribbean may result from low productivity rather than vice versa. Economies with low TFP growth tend to be economies in which returns to investments are low, with low saving rates as well. In that sense, low TFP growth, by providing weaker incentives to save, could be another determinant of the low saving rates observed in the region. Moreover, firms need to invest, which in turn requires that they can access financial markets. If instead, firms are constrained because of financial frictions, some entrepreneurs may have to run small firms and save in order to fund their projects, slowing down aggregate productivity growth. This note further examines the distribution of private savings in the economy and the behavior of firm saving to explore whether financial frictions distort price signals and incentives to save.

JEL classifications: E13, E21, E22, E23

Keywords: Total factor productivity, Firm productivity, Saving, Latin America and the Caribbean

1. Introduction

Firms in Latin America produce less than those in developed countries using similar amounts of capital and labor. This gap results from the persistently low growth of aggregate total factor productivity (TFP) which has characterized the region for the past half century.[1] Such stagnation in productivity growth is often blamed on the lack of infrastructure such as roads, ports and telecommunication networks. In turn, this lack of infrastructure is associated with a limited availability of funds from domestic sources; that is, with low domestic savings. According to this view, low saving rates are an obstacle to productivity growth and result in poor economic performance. In that case, policy interventions that increase the saving rate are beneficial in their own right. While in principle this view could be correct, it often leads to considering saving decisions as exogenous and hence overlooks the incentives that lead agents to postpone consumption today in order to save more and increase their wellbeing tomorrow.

This paper explores whether the opposite causal mechanism is likely to operate in Latin American and the Caribbean economies. It puts forward and explores the idea that productivity growth is not only a fundamental driver of long-run economic growth but, crucially, that it also constitutes an important determinant of saving. Economies with low TFP growth tend to be economies in which returns to investments are low. Thus, it is not surprising that saving rates will be low, too. In that sense, low TFP growth, by providing weaker incentives to save, could be another determinant of the low saving rates observed in the region. The first half of this paper explores this idea.

Since aggregate TFP is a weighted average of individual firm productivities, its level grows when more productive firms take up a larger fraction of production. This way, an economy in which productive firms can grow fast is an economy with high TFP growth. In order to grow, however, firms need to invest, which in turn requires that they can access financial markets. If firms are instead constrained because of financial frictions, some productive entrepreneurs may have to run small firms and save in order to fund their projects, slowing down the process of aggregate productivity growth. Lower aggregate TFP growth would then result in

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[1] Box 1 defines aggregate productivity and its relationship with firm-level productivity.

a lower (aggregate) return to investment, providing fewer incentives to save for those outside the firm. In this situation, aggregate savings will be lower, although the share of savings by firms (rather than households) will be higher. The second part of the paper looks at the distribution of private savings in the economy and at the behavior of firm saving in search of evidence that financial frictions distort price signals and incentives to save. That is, it looks at whether financial frictions partially break the relationship between aggregate productivity growth and savings.

Box 1. About Productivity

Economists define aggregate total factor productivity (TFP) growth as the proportion of output growth that cannot be explained by the growth in the inputs used in production (labor and capital). That is, if an economy is able to increasingly extract more output from the same amount of resources, it is said that there is TFP growth.

Economists have sought to explain why some economies are more productive than others and, in recent years, have moved beyond the concept of aggregate productivity to examine its micro-foundations. TFP is ultimately the *weighted* (w_i) sum of the *productivity* (A_i) of the *existing* population (Φ) of firms currently operating in the economy.

$$TFP = \sum_{i \in \Phi} w_i A_i$$

It is useful to analyze three objects of this definition. First, the productivity of each firm is a function of a number of traits, such as entrepreneurial ideas, organization of the firm, ability to innovate, ability to extract effort from workers. In particular, consider a simple (but general enough) firm production function as $Y_i = A_i F(K_i, L_i)$. That is, using a production function $F(.)$ that combines capital (K_i) and labor (L_i), a firm with productivity A_i is able to produce Y_i. An economy populated with firms that are able to extract more output from the same amount of inputs (i.e., higher A_i in a substantial number of firms) would be more productive.

Second, the weights in the summation are given by the share of resources that are employed by each firm (i.e., $w_i = w(K_i, L_i)$), or by the observed allocation of resources in the economy. This allocation is the result of firms' hiring decisions, given the cost of inputs faced by each firm. In a market economy, the efficient allocation is one in which all firms equate their marginal product of labor and capital to the equilibrium prices (wages and rental value of capital). Typically, however, there are distortions that introduce a wedge between the market price of each factor and the factor cost actually observed by the firm. These distortions could arise because of regulations, taxation, imperfect enforcement of laws, frictions in financial markets, market failures, and so on. Because they change the factor prices faced by each individual firm, they also change their hiring decisions and thus they change the actual allocation of resources in the economy. In such cases, it is said that resources are misallocated in that their allocation is not efficient. An economy that allocates relatively more resources to its least productive firms will have lower TFP than one that allocates relatively more resources to its more productive firms.[2]

Third, the terms of the summation are over the *existing* population of firms (Φ). An economy that allows its more productive entrepreneurs to acquire resources and to operate in the market would be more productive than an economy that favors less productive entrepreneurs. An economy with more *Schumpeterian* competition in which the more productive entrepreneurs and firms win market share and prosper while the least productive lose market share and eventually exit the market is more productive than one that favors the least productive.

Consequently, TFP can grow because firms in the economy are becoming more productive, because the allocation of resources is moving closer to the efficient allocation, or because the market allows more productive firms to survive and induces less productive firms to exit.

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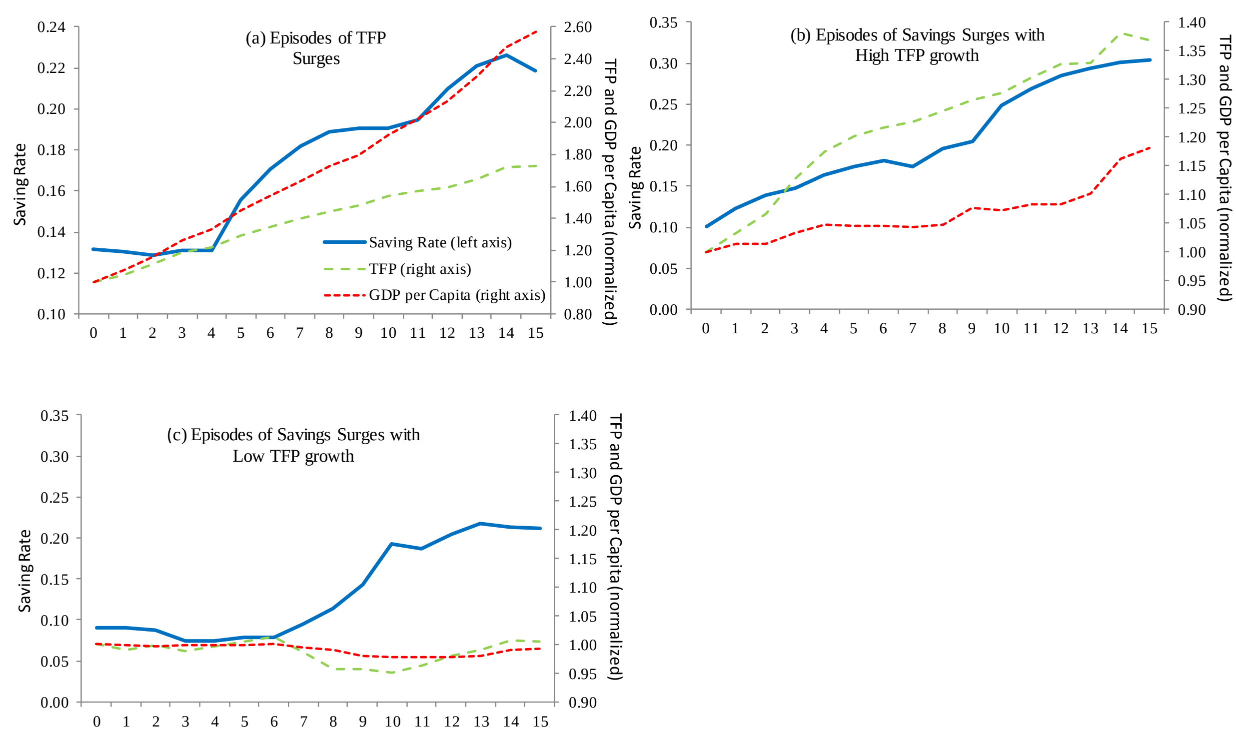
2. Episodes of TFP and Savings Acceleration

A useful starting point for understanding the relationship between saving and TFP growth is to characterize the main patterns in the data. This section does so by looking at episodes of sustained TFP growth in the Penn World Tables, an annual panel of 167 countries spanning the 1950 to 2011 period. In addition, this section looks at separate episodes of surges in the saving rate. In both types of episodes, this section studies the evolution of output per capita.[3]

[2] Because of decreasing returns, it is never optimal that all resources go to the economy's most productive firm.
[3] See Appendix A for further details on the data and methodology used in this section.

Episodes of high TFP growth have been characterized by increases in saving rates. This is illustrated in panel (a) of Figure 1, which plots the simple average across 15 episodes of large and sustained TFP growth identified in the data.[4] Three variables are plotted: TFP, real output per capita, and the saving rate. The saving rate is measured as gross national savings over GDP, and TFP and real output per capita are normalized to one during the first year of the episode. As depicted in Figure 1, 15 years after the beginning of these episodes, on average, TFP nearly doubles, output per capita multiplies by a factor of 2.6, and the saving rate nearly doubles from around 12 percent to 22 percent.[5] Importantly, the timing of the increase in the saving rate does not follow a smooth increase as for the other two variables. The increase in the saving rate occurs only in the fifth year after the episode of TFP growth began.

Figure 1. Episodes of Surges in TFP and Saving Rates



Source: Penn World Tables and authors' calculations.
Note: Numbers reported are averages across episodes. TFP and real GDP per capita are normalized to be 1 in the first year of the episode. The horizontal axis represents the years since each episode starts. For a list of individual episodes and for methodological details for defining them see Appendix A.

[4] Appendix A contains further details about the specific criteria used when identifying these episodes as well as the complete list of them.
[5] In 11 of the 15 episodes of fast TFP growth identified, we observed an increase in the saving rate. See Appendix A.

The large increase in output per capita that accompanies an episode of sustained TFP growth is in line with a large body of theoretical and empirical research on economic growth. Since at least the seminal contributions of Solow (1956), it is well known that only increases in productivity can sustain increases in income per capita in the long run. Because of diminishing marginal returns to capital and to labor, increases in either one of these factors of production eventually exhaust their contribution to output growth. In the case of Latin America, Pagés (2010) documented how low TFP growth is the key driver of economic growth in the region. We also find this pattern when applying a simple growth accounting exercise over the 11 growth miracles identified by the Commission on Growth and Development (2008). We find that nearly half (48 percent) of the increase in output during these episodes can be traced back to TFP growth.[6]

Another crucial empirical regularity from the data is that not all episodes of saving rates surges are accompanied by increases in output per capita. It is only when those episodes are also accompanied by TFP growth that one observes increases in real output. This is illustrated in panels (b) and (c) of Figure 1, where 22 episodes of large and sustained increases in the saving rate are analyzed.[7] The episodes are divided into those in which TFP increased by at least 10 percent within a decade (panel (b)), and those in which it increased by less than that (panel (c)). In the episodes of saving surges characterized by high TFP growth, the saving rate tripled from 10 percent to almost 30 percent within 15 years, while TFP and income per capita increased by a factor of 1.4 and 1.2, respectively. By contrast, in episodes of saving surges characterized by low TFP growth, this variable essentially stagnated alongside income per capita.

We can extract an important lesson from this analysis: if saving and productivity can foster investment and growth, it seems that they should not be studied in isolation. The empirical facts indicate that productivity growth is another important variable when trying to understand the behavior of saving and its contribution to economic growth. This is consistent with two empirical regularities that have been documented systematically about Latin America: its exceptionally low saving rates (see Chapter 2 of Cavallo and Serebrisky, 2016) and its persistently low productivity growth (Pagés, 2010).

[6] See the tables in Appendix A. See Footnote 15 for a caveat stemming from mismeasurement in TFP.
[7] See Appendix A for further details on the set of criteria used to identify these episodes as well as the complete list of episodes. When plotting the episodes of low TFP growth we do not include Rwanda (1985-95) due to the episodes of political and social unrest during this period.

3. Incentives to Save: The Role of Productivity

In early growth theory (Solow, 1956), exogenous increases in saving rates lead to higher investment rates and temporarily faster economic growth. Thus, a natural implication of this theory is that policy interventions that increase the saving rate are beneficial in their own right. While this approach has guided much of the empirical literature on saving and growth (Mankiw, Romer and Weil, 1992), the exogeneity assumption embedded in this reasoning misses the important point of what the incentives for saving are. By contrast, neoclassical growth theory—the workhorse of modern macroeconomics—posits that saving is an endogenous decision that depends on investment returns.[8,9] This section studies saving decisions using neoclassical growth theory.

Neoclassical theory has two key building blocks. First, agents make consumption and labor choices to maximize their lifetime well-being. Second, capital and labor are combined in production under constant returns to scale with varying degrees of technical efficiency.[10] When capital is relatively scarce, agents usually save in order to invest and grow, so as to increase future income and lifetime welfare.

Thus, a crucial ingredient in this theory is that saving decisions are determined endogenously by investment returns, which in turn depend on the behavior of several exogenous forces. First, TFP growth is a key determinant of returns to investment, which is equivalent to saving in a closed economy.[11] Second, depreciation rates also affect net investment returns and, in this way, can influence saving behavior. A third determinant of investment returns is the level of government taxation of capital income; if high enough, taxation may considerably reduce incentives to save.[12] Fourth, higher government consumption can also be an important drag on the resources available for saving, while higher population growth requires larger saving efforts in the long run.

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[8] Bernanke and Gurkaynak (2002) clearly state the differences between these two theories and point out that the positive correlation between savings and growth rates observed in the data supports the hypothesis that saving rates are endogenous.

[9] Following Acemoglu (2009), neoclassical growth theory refers to the Ramsey–Cass–Koopmans tradition.

[10] Constant returns to scale imply that if both inputs of production are doubled, total output doubles as well.

[11] In this paper, only the closed-economy case is considered, where saving (S) and investment (I) are one and the same. The assumption is not far-fetched: as documented elsewhere in the book, there is evidence of high correlation between S and I in the data, which was also shown in earlier work by Feldstein and Horioka (1980).

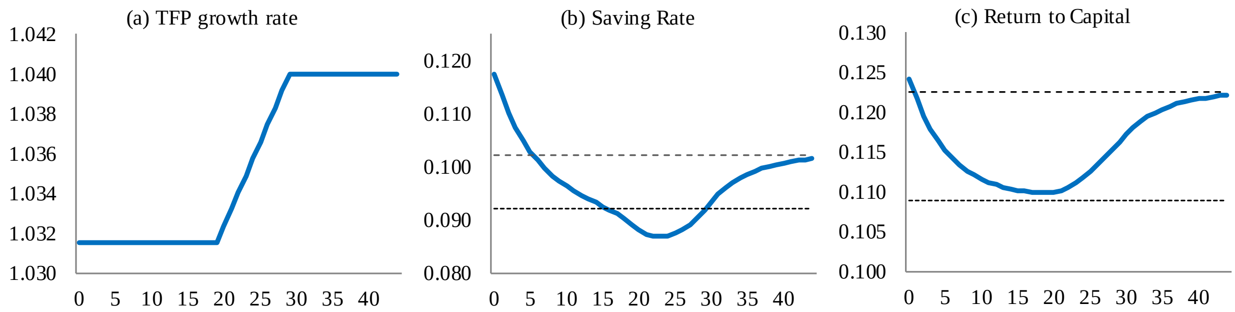
[12] The same may be said of any friction or distortion that introduces a wedge in marginal products. For now, we abstract from these issues and explore them fully in the second part of this paper.

We illustrate how this theory works with a simple simulation; a full description of the neoclassical model is presented in Box 2. Figure 2 displays a model-based simulation of the saving rate and the rate of return to a permanent expected increase in TFP growth.[13,14] Agents in this economy start in period 1 knowing that productivity growth for the next 20 periods will be constant at 3.1 percent and that afterwards it will permanently increase to 4 percent as shown in panel (a) of Figure 2. Faster productivity growth implies that agents can extract increasingly larger amounts of output from each unit of capital, effectively increasing investment returns. In that case, agents will find it optimal to postpone consumption today in order to save, invest, and later reap the benefits of this future increase in productivity. As shown in panel (b), the economy increases its saving rate above its long-run steady state, which is equal to 10.33 percent (dashed line). Note that this level will be higher than the one that would have prevailed in the event that productivity growth had remained at 3.1 percent (dotted line). Likewise, as depicted in panel (c), the steady state rate of return on capital permanently increases along with productivity growth. Before the actual increase in productivity growth materializes this return gradually decreases as capital is being accumulated and then slowly increases, converging to its steady state.

It is important to note that, as presented in the simulation, if there is certainty about the path of future productivity growth, the increase in saving rate may precede the boost in productivity, yet the causality implied by the model runs in the opposite direction. Additionally, even though the saving rate increases at the beginning and before the actual increase in productivity growth materializes, it does not need to increase for every period until the actual boost in productivity growth takes place. This is due to the virtuous circle triggered by the accumulation of capital, which allows more resources to be produced, thus sustaining more investment and consumption. In the more realistic case where there is uncertainty about the future path of productivity, one would still observe a positive co-movement between saving rates and productivity growth at the time an unexpected boost in the latter materializes.

[13] The model is parameterized as explained in Box 2.
[14] The simulation is computed over 100 periods but only the first 45 are presented as convergence to the steady state is reached afterwards.

Figure 2. Expected Permanent Increase in TFP Growth Rate in the Neoclassical Model



Notes: The figures reproduce the dynamics for 45 periods following an expected and permanent increase in the annual TFP growth rate in period 20 from 3.1 percent to 4 percent. Dashed and dotted lines are steady-state levels with the TFP growth rates of 4 and 3.1 percent, respectively.

Box 2. Neoclassical Growth Model

In the simplest version of the neoclassical model (Cass, 1965; Koopmans, 1965), a representative agent decides on labor, consumption, and capital accumulation to maximize lifetime utility subject to resource and technological constraints. The agent's objective function is given by:

$$max \sum_{t=0}^{\infty} \beta^t N_t [log c_t + \alpha log(T - h_t)]$$

where $N_{t+1}/N_t = n_t$ is the population growth and $c_t = C_t/N_t$, $h_t = H_t/N_t$ are the individual per capita consumption and labor choices. Technology takes the form of a constant-returns-to-scale Cobb–Douglas production function that combines capital (K_t) and labor (H_t) inputs. $Y_t = A_t K_t^{\theta} H_t^{1-\theta}$, where A_t is a measure of TFP. In addition, the representative agent's choices are subject to the resource constraint:

$$C_t + K_{t+1} - (1 - \delta_t)K_t = w_t H_t + r_t K_t - \tau_t(r_t - \delta_t)K_t - \pi_t$$

where r_t is the pre-tax rental rate of capital, τ_t is the tax rate on income from renting capital, δ_t is capital depreciation, and π_t is a lump-sum tax resulting from the government's budget constraint:

$$G_t = \tau_t(r_t - \delta_t)K_t + \pi_t$$

where G_t denotes exogenous government consumption. Since r_t is the income received from installing and renting an additional unit of capital it effectively captures pre-tax investment returns. Let $\gamma_t = (A_{t+1}/A_t)^{1/(1-\theta)}$ be the growth rate TFP. In this economy, because γ_t and n_t

are different from zero in the long run ("steady state"), some of the endogenous variables will contain a trend (i.e., will not be stationary). For this reason, in the foregoing analysis we study the behavior of consumption, output and capital in terms of efficiency units of labor. That is, for $X_t = K_t, C_t, Y_t$ we define $\tilde{x}_t = X_t / \left[N_t A_t^{1/(1-\theta)}\right]$ as the de-trended or normalized values of C_t, K_t, Y_t, or the amount of consumption (capital, output) per units of efficiency labor, $N_t A_t^{1/(1-\theta)}$. We also define $g_t = G_t/Y_t$ to be government consumption as a share of output. The equations that characterize optimal decisions are: the optimal labor supply equation $\tilde{w}_t = \alpha h_t/(T - h_t)$, as well as

$$\gamma_{t+1}\tilde{c}_{t+1} = \beta\tilde{c}_t\{1 + (1 - \tau_{t+1})[r_{t+1} - \delta_{t+1}]\} \quad (1)$$

$$\tilde{k}_{t+1}\gamma_{t+1}n_{t+1} = (1 + r_t - \delta_t)\tilde{k}_t + \tilde{w}_t h_t - g_t\tilde{y}_t - \tilde{c}_t \quad (2)$$

Equilibrium prices and market clearing in the goods market yield the conditions:

$$r_t = \theta\left(\tilde{k}/h\right)^{\theta-1}, \ \tilde{w}_t = (1-\theta)\left(\tilde{k}/h\right)^{\theta}, \text{ and } \tilde{y}_t = \tilde{c}_t + \gamma_{t+1}n_{t+1}\tilde{k}_{t+1} - (1-\delta_t)\tilde{k}_t + g_t\tilde{y}_t$$

In this economy, a handful of exogenous forces drive inter-temporal choices, like saving decisions. In particular, saving decisions are determined by γ_t, as well as g_t, τ_t, n_t, and δ_t. The main equation characterizing (net) saving behavior is:

$$s_t = \frac{Y_t - G_t - C_t - \delta_t K_t}{Y_t - \delta_t K_t} \quad (3)$$

A steady state of this dynamic system is a situation in which all de-trended variables are constant (hence we drop subscripts). In this case, equation (1) becomes:

$$\gamma = \beta[1 + (1-\tau)(r - \delta)],$$

which states that the return of an additional unit of capital (investment), r in the long run is determined by household preferences, β, and by the long-run behavior of depreciation, taxes and productivity growth. With equilibrium in the labor market, the return to capital then determines the steady state level of capital through the relationship $r = \theta\left(\tilde{k}/h\right)^{\theta-1}$. This in turn allows us to re-write equation (3) as:

$$s = \frac{(\gamma n - 1)\tilde{k}}{\tilde{y} - \delta\tilde{k}}, \quad (4)$$

where $\tilde{y} = \tilde{k}^{\theta} h^{1-\theta}$. As an illustration of the model's mechanism, simple comparative statics on the steady state of the model are now presented. In order to establish a benchmark, parameter and steady-state values are set following the calibration of Japan in Chen, Imrohoroglu and Imrohroglu (2006). In particular, we set: $\theta = 0.36, \delta = 0.1, \gamma = 1.0315, n = 1.0119, \tau = 0.35, \beta = 0.97, \alpha = 1.45$, and $g = 0.14$, defining a steady-state saving rate of $s = 9.2$ percent. The following table summarizes this benchmark parametrization and the resulting saving rate.

Benchmark Parametrization and Saving Rate

α	δ	β	γ	g	τ	n	θ	s
1.45	0.1	0.965	1.032	0.14	0.35	1.012	0.36	9.2%

Next, some of these parameter values are varied one at a time to study their impact on the steady-state saving rate. In particular, we use the exact parametrization of Japan, replace only one of δ, γ, n, τ with the value that is calibrated for Mexico, and compute the saving rate in each case. The following table presents the results from this exercise.

Comparative Statics

	$\delta = 0.05$	γ=1.006	$\tau = 0.2$	$n = 1.017$
New s	11.3%	4.9%	10.4%	10.3%
Change w.r.t. benchmark	+2.1pp	-4.3pp	+1.2pp	+1.1pp

Notice that g is a driver of the saving rate's transitional dynamics but not of its steady state, as equation (4) reveals. This follows directly from the fact that government consumption in this model is considered wasteful; it does not produce public goods that can be used for production or utility. Instead, TFP growth plays a major role in the long-run saving rate. For instance, if Japan had the long run TFP growth of Mexico, its saving rate would have been 4.9 percent rather than 9.2 percent. On the other hand, the lower tax rate calibrated for Mexico would imply a saving rate of 10.4 percent, the lower depreciation would in turn result in a 11.3 percent saving rate, and the higher population growth would predict a saving rate of 10.3 percent.

4. Savings and Productivity Growth: Three Case Studies

In order to empirically assess the predictions of neoclassical theory, it is worthwhile to study the dynamics of the saving rate in three post-war experiences: Japan, Chile, and Mexico. While the case of Japan has been studied widely elsewhere,[15], Mexico and Chile provide two examples in Latin America of two opposing experiences in terms of productivity growth and saving rates dynamics. The exercise can be summarized as follows. First, the neoclassical model is parameterized to match certain long-term data averages in each country. Then, the observed series for TFP growth, population growth, taxes, and government consumption are fed into the model to produce a model-based simulated series of the saving rate. By turning off some of these determinants we can assess their relative importance.

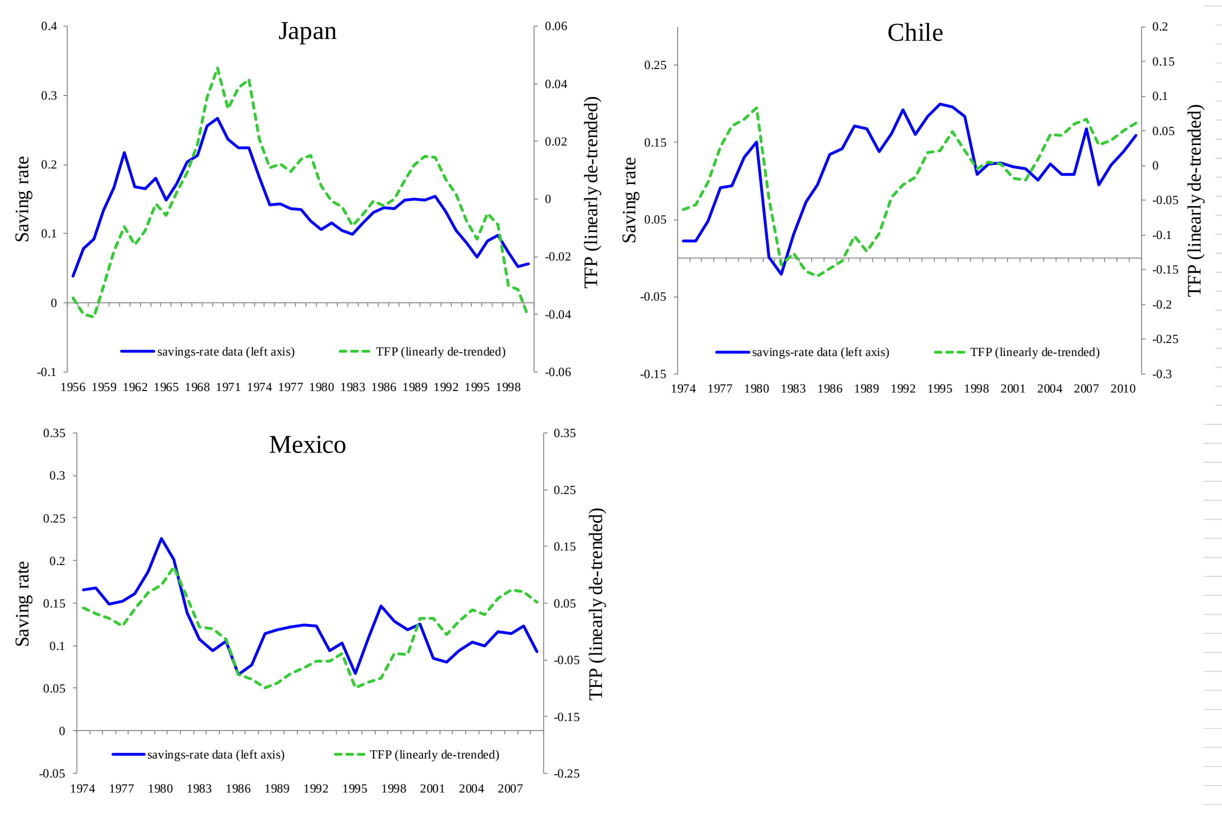
Figure 3 presents time series of TFP and saving rates.[16] As discussed in Ito (1996), Japan experienced rapid productivity growth during the 1960s and 1970s, when its saving rate increased substantially. In Chile and Mexico, there was a sudden rise and fall of productivity around the early-1980s "debt crisis."[17] From the mid-1980s, both productivity growth and the saving rate recovered in Chile but failed to do so in Mexico.

[15] For a literature survey, see Horioka (1990).

[16] Because we later provide a comparison between the data and the model, we look for an aggregate that is comparable to the model's saving rate. Thus, in Figures 3 and 4 we plot the net investment rate that results from investment data (the IMF's International Financial Statistics) and constant depreciation of 5 percent. The correlation between this series and the series of net saving rate from the World Development Indicators for 1960-2010 is 0.55.

[17] What this paper terms "productivity" is approximated by the Solow residual computed using observed measures of capital and labor. The lack of long time series on the intensity with which the stock of capital is used makes the Solow residual in this study subject to the usual mismeasurement problems. However, Meza and Quintin (2007) documented that for Mexico the Solow residual falls during the Tequila crisis, even after controlling for intensity in capital use.

Figure 3. TFP Dynamics and the Saving Rate: Japan, Chile, and Mexico



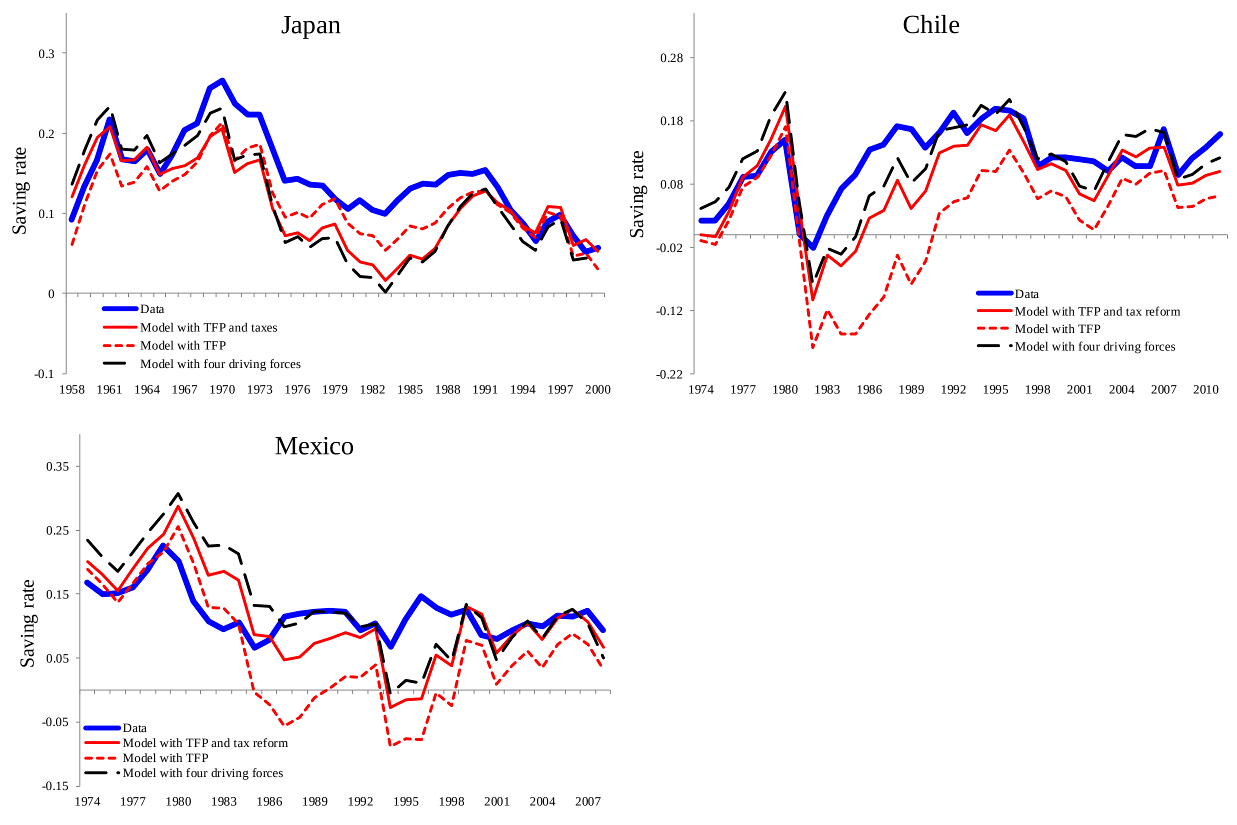
Source: Authors' calculation based on data from International Financial Statistics, Kehoe and Meza (2011) and Bergoeing et al. (2002).
Notes: The series labeled "TFP (linearly de-trended)" corresponds to the residuals from a regression of the natural logarithm of TFP on a linear time-trend variable. TFP corresponds to the Solow residual. The saving rate is as defined in footnote 15.

Japanese saving rates during the second half of the twentieth century appeared particularly high compared to the United States. To explain this, Hayashi (1989) hypothesized that such saving rates could result from the kind of convergence dynamics implied by neoclassical growth theory, in which an economy starting from low capital intensity accumulates capital (i.e., saves) until diminishing returns lead the economy to a constant capital–output ratio. Indeed, Japan entered the second half of the century with very low capital following the wartime destruction. However, Christiano (1989) pointed out that the period for which Japan continued to save and accumulate capital was simply too long to be accounted for by simple convergence dynamics, and that the hump-shaped behavior of savings was inconsistent with the theory's predictions, at least in the absence of some additional exogenous force. Other alternatives, such as housing finance institutions and tax policy, did not offer a complete explanation for the large gap between average U.S. and Japanese saving rates in the 1970s (Hayashi, Ito and Slemrod, 1988). Chen, Imrohoroglu and Imrohoroglu (2006) showed what was missing in these attempts to explain Japan's saving rate: the actual observed behavior of aggregate productivity growth, which, as argued above, is a key determinant of investment returns, and therefore, of savings incentives.

Chen et al.'s (2006) approach was to use a neoclassical growth model parameterized to match the Japanese data with the observed series of TFP growth, population growth, effective rates of capital taxation, and government consumption.[18] The top-left panel of Figure 4 reproduces this result from Chen et al. (2006) under the label "model with four driving forces." In addition, we have also carried out the simulations using only the series of TFP growth and capital tax rates, while leaving government spending and population growth constant at their sample averages. Finally, under the label "model with TFP," we have used only the TFP growth series to simulate the saving rate, while keeping the remaining three exogenous forces at their sample averages. The main conclusion is that, once rapid growth in productivity is accounted for, there is no savings puzzle in Japan, as the model properly tracks Japan's observed saving rate evolution.

[18] See Appendix B for details.

**Figure 4. Saving Rates in Japan, Chile, and Mexico:
Neoclassical Model Predictions and Data**



Source: Authors' calculations and Chen, Imrohoroglu and Imrohoroglu (2006).

In addition to the tax rates mentioned before, actual series of government consumption, population growth, and TFP growth were fed into the model, first jointly and then sequentially.[19] The simulated saving rates are presented in the bottom-left panel of Figure 4 along with the data. The series labeled "model with four driving forces" includes TFP growth, population growth, government consumption and a tax rate of 53 percent for 1970–1988 and 22 percent thereafter. The series labeled "model with TFP and tax reform" sets government consumption and population growth at their sample averages but includes the 1987 "tax reform," while the series labeled "model with TFP" uses a tax rate of 55 percent for the entire period.

Two important observations emerge from the results. First, TFP growth and capital tax rates ("wedges") are able to track the Mexican saving rate fairly well. In particular, the model with only these two driving forces is able to account for the rise and fall in the saving rate around

[19] See Appendix B for definitions.

the time of the debt crisis and for its subsequent stagnation.[20] Second, while productivity growth greatly helps in accounting for the *dynamics* of the saving rates throughout this period, investment distortions, which we labeled "capital tax rates," played an important role in explaining the saving rates *level* in the aftermath of the debt crisis. This observation highlights the importance of the corporate tax reform implemented in the late 1980s. However, uncertainty surrounding our measures of capital "wedges" suggests complementary explanations that point to market or other policy distortions to capital accumulation. These explanations include lack of appropriate credit to the private sector due to the significant banking meltdown that followed the crisis (Gruben and Welch, 1996); a large sovereign debt overhang and the possibility of higher future taxes, which may have discouraged investment (Sachs, 1989); and worsening of enforcement frictions that may have led to poor sorting of bankrupt firms in the immediate aftermath of the crisis (Bergoeing et al., 2002).

In the case of Chile, the parameterization of the model closely follows Bergoeing et al. (2002), who study the Chilean economy around the "lost decade" using the neoclassical model.[21] Again, owing to the lack of reliable data, capital tax rates were set at 55 percent between 1960 and 1987 and 12 percent thereafter, following Bergoeing et al (2002). Hsieh and Parker (2007) presented compelling evidence that corporate tax rates were lowered by these approximate magnitudes around 1986–87. With the parameterization for Chile at hand, the model was then inputted with actual series for TFP growth, population growth, and government consumption. The results are presented in the upper-right panel of Figure 4.

First, the series labeled "model with four driving forces" shows that this simple version of the neoclassical model can reproduce major trends in the Chilean saving rate, perhaps even better than for Mexico. The model predicts an increase and then a dramatic drop in the saving rate around the time of the debt crisis. In sharp contrast to the Mexican case, in Chile, the saving rate experienced a sustained increase starting in the years after the crisis and throughout the 1980s and early 1990s. To determine the main driver of this increase, we compare the three saving rates produced from the model using different datasets and find that the main determinant

[20] However, the model appears to miss some short-run dynamics. This is expected given the superior data with which Chen, Imrohoroglu and Imrohoroglu (2006) were able to work. These authors had complete times series of capital tax rates and carefully constructed depreciation series from Hayashi (1989).

[21] As for Mexico, the discount factor in Chile is set at 0.97, the capital share parameter at 0.3, and the depreciation rate at 5 percent. On the other hand, the labor elasticity parameter was set lower than in Mexico, reflecting that average hours worked in Chile were somewhat above those in Mexico.

for such behavior is the strong TFP growth following the crisis years. Again, capital taxes or investment wedges are important in determining the *level* of the saving rate, perhaps to a larger extent than for Mexico. This is consistent with the findings of Cerda et al. (2015) who argue that the large drop in tax rates on retained earnings (from close to 50 percent in 1985 to 10 percent in 1988) provided plenty of saving incentives in the years following the reform.[22]

To sum up, three main lessons can be derived from the analysis of these case studies. First, as other studies found for Japan, the model with all its driving forces is able to replicate broad trends in the saving rates of Mexico and Chile. However, the simulations appear to miss some short-run dynamics, especially around the crisis years of 1994–96 (Mexican Tequila Crisis) and 1998–2000 (Chilean Sudden Stop). In a sense, this is to be expected from a closed-economy model since, during these years, sharp reversals in capital flows forced these countries to save despite considerable declines in productivity. Second, the counterfactual simulations show that an important determinant for the *dynamics* of the saving rate in both Chile and Mexico is the behavior of productivity growth, which supports the hypothesis that incentives (i.e., investment returns) matter for saving decisions. Finally, we have seen that investment "wedges" also played a role in determining the *level* of saving rates. In addition, while tax reforms in the aftermath of the debt crisis may have been important, our limited information forces a consideration of this issue in more general terms of distortions to investment decisions.

5. Beyond the Neoclassical World

Even though the neoclassical model has a simple and tractable setup that can rationalize a causal role from productivity growth to saving, it has some important limitations, mainly i) the exogeneity in the path of productivity, ii) the closed economy assumption and iii) the presence of a representative agent/firm in the economy. The literature has relaxed some of these assumptions, sometimes with important implications for the linkages between productivity and savings.

Aghion et al. (2009) developed a theory of endogenous productivity and growth in an open economy with domestic and foreign investors, in which growth in relatively poor countries results mainly from innovations that allow local sectors to catch up with the current technology

[22] Again, our analysis is of the economy-wide saving rate, but Cerda et al. (2015) argue that such a drop in capital tax rates stimulated mainly saving by firms.

frontier. However, doing so requires the cooperation of a foreign investor who is familiar with the frontier and a domestic entrepreneur who is familiar with the local conditions to which the technology must be adapted. In such economy, domestic savings matter for technology adoption, and therefore, for growth, because they allow the local entrepreneur to take an equity stake in this cooperative venture, which mitigates an agency problem that would otherwise discourage the foreign investor from participating. The model's main prediction was that savings affect growth positively in those countries that are not too close to the technological frontier, but do not affect it at all in countries close to the frontier.

The traditional neoclassical economy is often depicted as a closed economy with no trade in assets or goods with the rest of the world. Textbook extensions of a neoclassical small open economy predict that capital will flow in with higher productivity growth. This prediction relies on the assumption that domestic and foreign savings are perfect substitutes. In other words, a country confronted with a sudden increase in productivity growth can import capital to finance its higher demand for investment. Hence a decoupling from investment and savings would occur. However, since Feldstein and Horioka (1980) evidence in favor of this decoupling has been elusive. De la Torre and Ize (2015), who argued for the presence of transaction costs that would make foreign and domestic savings imperfect substitutes, have recently confirmed this for Latin America. Gourinchas and Jeanne (2013) have further provided evidence of this and, in addition, shown that the difference between saving and investment (i.e., capital outflows) is *positively* correlated with productivity growth, a phenomenon they called the allocation puzzle. Importantly for this paper, they also extend the open economy neoclassical model with investment and saving wedges and find that the investment wedge cannot, by itself, explain the puzzle, and that solving the allocation puzzle requires a saving wedge that is strongly negatively correlated with productivity growth. That is, the allocation puzzle is a saving puzzle.

Lastly, another important limitation of the neoclassical model is the absence of heterogeneity among producers or households (Restuccia and Rogerson, 2008). In the absence of endogenous technical progress, the homogeneity assumption entails treating aggregate productivity growth as exogenous, and forces one to study consumption, labor, and saving decisions from the standpoint of a representative agent (i.e., without distinguishing between firms or households). In particular, who carries out saving decisions is immaterial in the sense that the same equilibrium allocations are reached regardless of whether firms or households are allowed to save.

Acknowledging that agents are heterogeneous along several dimensions—for instance, in terms of wealth and productivity—has two important implications. First, aggregate productivity growth is an endogenous variable, which results from combining the levels and growth rates of individual productivities of all operating firms at a given point in time (see Box 1). Second, the efficient allocation of capital requires institutional arrangements, such as financial markets, for savings to flow across firms and sectors toward their most productive use. In other words, with heterogeneous agents and underdeveloped financial markets, who saves and how much matters.[23] This is particularly important, as we have shown that distortions in investment decisions ("wedges," such as government taxation or financial market frictions) account for a significant portion of the saving rates in both Mexico and Chile. For this reason, heterogeneity and distortions in saving–investment decisions are the focus of the remainder of the paper.

6. Zooming In: Firms' Savings Decisions

Since entrepreneurs are, by nature, heterogeneous in terms of their ideas and abilities to organize production, firms in the economy have different productivities. Who gets to produce, and how much, matters for aggregate productivity. If a highly productive entrepreneur faces severe financial market frictions such that she cannot obtain the credit necessary to fund projects, the firm's growth would be constrained dramatically as it will need time to accumulate internal funds. This results in lower long-run aggregate productivity growth.

As discussed in previous sections, lower productivity growth would provide fewer incentives for the economy to save, and financial frictions can play an important role in this outcome. In other words, financial frictions result in lower aggregate saving, and in a higher share of saving done by firms (rather than households). Motivated by this observation, we analyze the distribution of private saving in the economy as well as the behavior of firm saving in search of evidence that financial frictions distort price signals and incentives to save.

However, before analyzing how financial frictions mediate in the relation between productivity growth and aggregate saving, it is useful to clarify why firms save. While

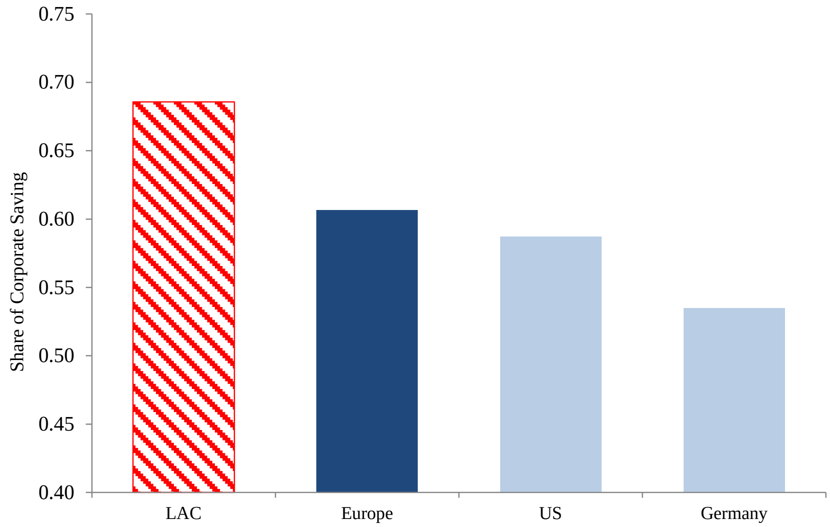
[23] Notice that, with perfect financial markets, heterogeneity has no real effect since all firms could freely borrow to quickly attain their optimal size. Likewise, imperfect financial markets without heterogeneity takes us back to the neoclassical world with investment wedges as described in Box 2.

households make saving decisions to maximize their inter-temporal utility subject to budget constraints, firms decide how much to invest and save to maximize their profits subject to the relative costs of the alternative funding sources (internal or external).

In an economy without any transaction, bankruptcy or agency costs, without any distortionary taxes, with symmetric information, and with efficient markets, the capital structure of the firm would be irrelevant for the firm value (Modigliani and Miller, 1958). In such an economy, there would be no reason for firms to save. If they needed funds to build new plants, buy new machinery, or weather unexpected temporary low sales or high expenses, they could borrow money from lenders and repay debts in the future. In that economy the cost of borrowing (interest rate) would be the same as the cost of internal funds. In a world with symmetric information, banks, knowing everything that the firm does, would provide those resources if the firm were to find it profitable in the long run; otherwise, the firm would not be willing to borrow money in the first place.

In the real world, however, there are transaction, bankruptcy, and agency costs, there are distortionary taxes, information frictions and markets can be inefficient. For simplicity, we refer to these as "financial frictions." These frictions make external financing relatively more costly than internal financing, thereby increasing incentives for firms to save rather than borrow money from lenders. Information frictions can prevent firms looking to borrow money from finding willing lenders, for whom it is costly to observe the viability of investment projects. This increases the cost of external finance and induces firms to save. In fact, the so-called pecking order theory of finance (Myers and Majluf, 1984) predicts that, based on firms' relative cost, it is optimal for them first to use their own savings, then to use debt, and finally, as a last resort, to issue equity.

Figure 5. Corporate Saving as Percentage of Private Saving



Source: Authors' calculations based on Bebczuk and Cavallo (2015).
Note: Latin America and the Caribbean (LAC) refer to Brazil, Chile, Colombia, Ecuador, Guatemala, Honduras, and Mexico. Europe refers to Austria, Belgium, France, Italy, the Netherlands, Portugal, Spain, Switzerland, and the United Kingdom. Data are for 2008–2012. Private saving is the sum of household and corporate saving.

Thus, the share of private saving done by firms can be rather large in most economies. Figure 5 shows the share of business saving in total private saving computed using national account data (Bebczuk and Cavallo, 2015). It plots information for a subset of countries in Latin America for which data are available and for three comparison regions/countries: core Europe, the United States, and Germany. Businesses in all regions under consideration are responsible for more than 50 percent of private saving, including Latin America, where the share of private saving by firms is 68 percent.[24]

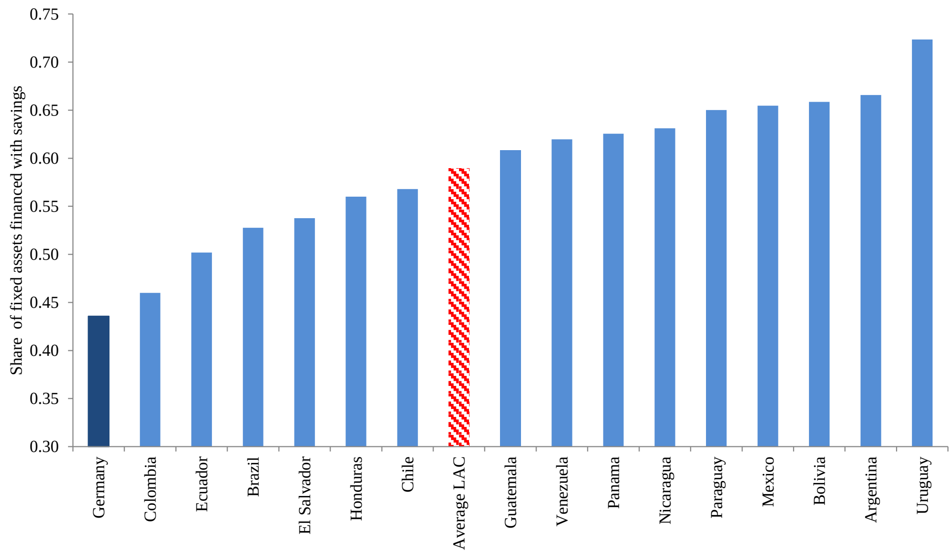
The literature has identified several reasons for firms to save.[25] First, firms must regularly meet cash needs for the ordinary course of business. Because it is costly to convert non-cash financial assets regularly into cash for payments, it is optimal for firms to hold cash to make those payments. Second, besides this transaction motive, there is a precautionary motive: businesses save to be able to react more rapidly to adverse shocks or investment opportunities

[24] Households in Latin America have lower saving rates than households in other regions of the world (see Chapter 9 of Cavallo and Serebrisky, 2016) which could also help explaining the relatively large share of firm to private saving rates in the region.
[25] See Bebczuk and Cavallo (2014) for a very complete treatment of this issue.

when access to capital markets is costly or takes time. Third, and perhaps most importantly, firms save to finance current and future investment.

In most economies, the average firm funds a large proportion of its investment projects using its own saving. Data from the World Bank Enterprise Survey (WBES) can be used to compute the average share of fixed assets financed with internal funds or retained earnings (i.e., firm savings).[26] Figure 6 shows the results. Firms in Latin America fund between 45 and 75 percent of their capital with their own savings. Note that even in Germany, a country with a more developed financial system, the average firm finances 44 percent of its fixed assets with its own savings.[27]

Figure 6. Share of Fixed Assets Financed with Savings (Internal Funds or Retained Earnings)



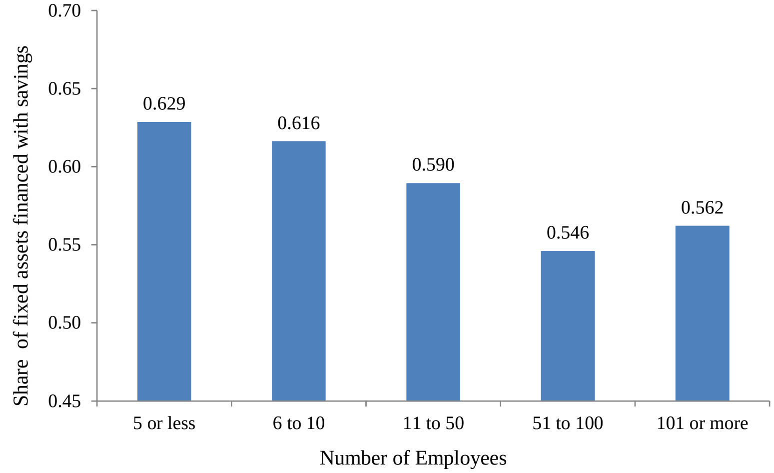
Source: WBES. See Appendix C for details.

Why do firms in certain economies seem to rely more heavily on their own savings to fund their capital stock? One likely explanation could be financial system underdevelopment. Firms that face less binding financial constraints rely less on internal funds to finance their capital investment. They usually face less stringent collateral requirements (Beck et al., 2005; 2008), and, given their size, are typically subject to less severe information asymmetries, giving rise to multiple sources of funding (Diamond and Verrecchia, 1991). Figure 7 shows that the

[26] See Appendix C for details.
[27] This result is similar to the one presented in Kawamura and Ronconi (2015). The main difference is that in this paper data from the WBES is re-weighted in order to keep constant the size distribution of firms across countries. This is done to prevent differences in the sampling frame of each country from affecting the results. See Appendix C for additional details.

share of internal funds to finance capital declines with size; it is smaller for less financially constrained firms.

Figure 7: Share of Fixed Assets Financed with Savings (Internal Funds or Retained Earnings)

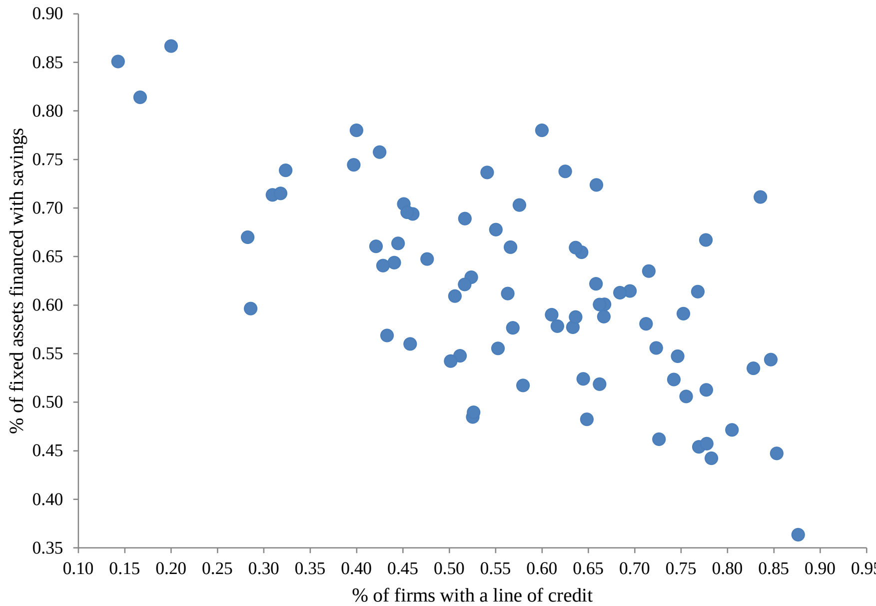


Source: WBES. See Appendix C for details.

Figure 8 utilizes a more direct measure by analyzing actual access to credit. In the scatter plot, each dot represents a country and size category combination. Cells in which a larger proportion of firms have access to credit tend to be those with a smaller average share of investment financed with saving.

Financial frictions seem to be a particularly acute problem in Latin American economies, which are characterized by low financial development. Fernández and Tamayo (2015) surveyed the institutional causes of financial underdevelopment and the effect on growth. They paid specific attention to the case of Latin America, where countries generally have poor institutions. The literature indeed indicates that poor institutions in the region—that manifest, for example, in poor creditor protection—have had effects on both the level and variability of credit, a proxy for financial development. Importantly, low financial development could have been a bottleneck in the process of resource reallocation following large-scale reforms implemented by many countries in the region during previous decades. Buera and Shin (2011), in particular, studied the interaction between the removal of policy distortions with the degree of financial development and showed that with low levels of financial development, the growth effects of removing such policy distortions are considerably delayed. Furthermore, Arizala, Cavallo and Galindo (2013) reported that the association of financial development with productivity is stronger in developing countries.

Figure 8. Correlation between Share of Fixed Assets Financed with Savings and Access to Credit



Source: WBES. See Appendix C for details.
Note: Each dot represents a country-bin size combination.

7. Firm Savings: A Remedy for Productive Firms to Overcome Financial Frictions

Firm saving can be considered an imperfect remedy for financial underdevelopment. Many studies have identified firm saving as means to overcome financial frictions in order for firms to grow and thus link saving to firm-level productivity and aggregate TFP growth. In this literature, firms usually start on small scales with ideas, low levels of capital, and only a few employees. Small firms learn to organize their business and practices and with time realize whether they are productive or not.

Small unproductive firms have low marginal product of capital and labor. They find no reason, need, or ability to expand. Depending on how much competition and price distortions they face in their sector, they can survive with low levels of capital. Consequently, they find no need to save much. They exit the market in which they operate with high probability in any given year (Davis, Haltiwanger and Schuh, 1996). In Latin America, these are usually small informal family-owned firms that survive mainly because some distortions allow them to pay lower input costs or to charge higher prices.[28]

For small productive firms, however, it is optimal to grow by hiring more labor and acquiring more physical capital. This process of firm growth usually requires long-term investments in the form of new and larger plants that imply substantial resources, which pay off gradually over time. Even if the sunk cost of investment is tiny relative to the potential stream of future profits, the firm could expect that costs can be very large compared to current low profits from a small plant. Saving for future investments could be the only way to grow, and this process could take a long time.

Therefore, the existence of financial frictions has implications both for aggregate TFP growth and for the level and type of saving done in the economy. To see this, assume there are three types of firms: small unproductive firms that remain small or eventually exit the market, small productive firms that would like to grow but cannot because of financial constraints, and firms that have already jumped to a larger scale.

In an economy with little financial frictions, small productive firms can borrow substantial resources to upgrade their plants. Large firms invest to maintain their physical capital. Small productive firms grow fast, increasing demand for capital and labor, which translates into higher wages and returns to capital accumulation. These price changes have many implications. First, higher wages eventually convince some small unproductive entrepreneurs to close their plants and become wage employees. Therefore, such an economy has a large share of large firms. Because productive firms grow fast, there is a small share of small productive firms, and almost no small unproductive firms. Since the total factor productivity of the economy is a weighted sum of the individual productivity, this economy experiences higher aggregate productivity growth. Second, higher (equilibrium) investment returns mean higher incentives for individuals to save, and aggregate savings are higher.

Consider now an economy with high financial frictions, assuming the same distribution of firm productivities as before. Small productive firms cannot borrow to upgrade plants and have to save a larger share of the required resources, and thus they remain small for longer. They do not increase labor demand and wages remain low. Nor do they increase demand for capital

[28] Busso, Fazio and Levy (2012) argued that, for Mexico, insufficient enforcement of labor regulations is a main determinant that allows small unproductive firms to survive.

and returns to capital accumulation remain low as well. In such an economy, the mix of firms is very different to the one described in the previous paragraph. There is a smaller share of large firms, a larger share of small productive firms that want to grow but cannot, and a larger share of small unproductive firms. Aggregate productivity growth and aggregate savings are lower. In addition, the ratio of firm-to-household savings is higher than before because saving is the only way for firms to upgrade their plants. In that sense, excessive firm saving signals an underdeveloped financial system.

Table 1 tests some of these propositions in the WBES data. We estimate a regression model in which the dependent variable is the share of fixed assets financed with savings and the independent variable is a measure of firm productivity proposed by Hsieh and Klenow (2009), which captures the firm's relative productivity with respect to the average firm operating in the same country sector. The regression models include a set of control variables (size dummies, country fixed effects, year fixed-effects, and firm age). It is important that the estimation is performed holding constant the size of the firm so that we capture the correlation of firm productivity and the use of firm savings to finance investments (i.e., to grow) within size categories. Each column reports the regression coefficients for different samples of firms according to whether they have credit lines and have applied for credit lines. We report only the coefficients of firm productivity. On average, more productive firms tend to save more, that is, the coefficient is positive but statistically insignificant. More importantly, productive firms without access to credit tend to save more than unproductive firms. This correlation is even stronger among firms that applied for credit but did not get one yet. In other words, this result shows that, holding the size distribution constant, more productive firms tend to save more. These are firms that require capital to grow but cannot access credit.[29]

[29] Appendix D provides some robustness checks to the results presented in Table 1. In general, the results hold but with less statistical significance.

Table 1. Firm Savings and Productivity

Dependant Variable: Share of Fixed Assets Financed with Firms' Savings	Whole Sample	Sample			
		Without a Line of Credit	With a Line of Credit	Without a Line of Credit but Applied	Without a Line of Credit and Did Not Apply
Firm Productivity	0.0095	0.0184*	0.0080	0.0662**	0.0079
	(0.0073)	(0.0091)	(0.0069)	(0.0247)	(0.0120)
Year Fixed Effect	Yes	Yes	Yes	Yes	Yes
Country Fixed Effect	Yes	Yes	Yes	Yes	Yes
Size Fixed Effect	Yes	Yes	Yes	Yes	Yes
Observations	7,012	2,270	4,713	416	1,854
R-squared	0.0624	0.0498	0.0471	0.1375	0.0472

Notes: Robust standard errors in parentheses. *** p<0.01, ** p<0.05, and * p<0.1.
Source: WBES. See Appendix C for details.

There is a relatively large recent literature that formally models the relationships between financial frictions, firm productivity, saving, and aggregate TFP growth along the lines outlined above. Midrigan and Xu (2014) used firm-level data to calibrate a model with some features described previously to Korea (an economy with low financial frictions), China, and Colombia (two economies with high financial frictions). They showed that without firm saving, the costs of financial underdevelopment would be much greater. They found that financial frictions have little impact on misallocation of resources across larger firms, which can pledge collateral to ease their borrowing constraint and, because of their larger scale, can invest more easily. At the same time, financial imperfections have a negative effect on the number of producers that operate in the economy and the scale those producers adopt. Firm saving have more limited ability to allow small firms to grow precisely because their saving capacity is small.

The nature of firm productivity is also important. Thus far, this paper has assumed that a firm’s original productivity level persists its entire life (i.e., productivity shocks are fully persistent). However, in reality, firms experience many productivity shocks over their life cycle. Positive productivity shocks increase the marginal product of capital and labor, thereby providing incentives for firms to grow. Moll (2014) argued that if productivity shocks were transitory, then firms in an economy with an underdeveloped financial system would have to save in order to grow when facing positive productivity shocks. Since building a stock of savings takes time, firms might not be able to save fast enough to reap the full benefits of the productivity shock. Entrepreneurs only have enough time to save when productivity shocks are persistent enough. Financial underdevelopment would be more costly for long-run TFP growth, for aggregate saving, and ultimately for economic growth in such a setting.

Buera, Kaboski and Shin (2011) used a similar model to explain the relationship between aggregate total factor productivity and financial development across countries. They assumed that, after production, entrepreneurs could renege on borrowing contracts. This imperfect enforceability of contracts introduces a financial friction that distorts the allocation of capital across firms and their entry/exit decisions, reducing aggregate productivity growth. In their model, forward-looking self-financing can alleviate the resulting misallocation. However, it is more difficult to self-finance on a larger scale with larger financing needs. Thus, sectors with larger scale (i.e., manufacturing) are affected more by financial frictions than sectors with smaller scale (i.e., services). The variation in financial development explains 80 percent of the difference between Mexico and the United States in output per worker.

In these models, the behavior of firm-level productivity affects the marginal product of capital providing incentives for firms to invest. Firms would like to borrow money to grow fast and exploit those productivity gains. More stringent borrowing constraints require higher levels of firm saving. In the long run, firm saving allows firms to overcome an economy's low financial development. Low financial development prevents fast reallocation of resources from unproductive to productive firms, which translate to lower TFP growth and a lower aggregate saving rate since individuals do not receive the right price incentives.[30]

Box 3. Firm Savings: Informality, Distortions, and Misallocation

In Latin America, there is a large number of small, informal, and unproductive firms that face lower costs of inputs or higher product prices because taxes and regulations are not properly enforced (Busso, Fazio and Levy, 2012). By distorting prices, informality can provide incentives for unproductive firms to grow even when they would not do so otherwise. The economic inefficiencies generated by these labor and tax distortions can be amplified by the ability of firms to save.

Consider a household that owns a small firm with low productivity, thus extracting less output from labor and capital. Suppose there are only labor market distortions: this informal firm

[30] Labor market and product market distortions might interact with those distortions generated by financial frictions. We explore these interactions in Box 3.

is less productive than a formal firm in the same sector and it does not pay labor taxes, and therefore has lower labor costs. For simplicity, assume capital is a complement to labor. Both firms hire labor and capital until the marginal products of these inputs equals their cost. The informal firm, facing lower costs of labor, would hire more labor and capital than in an efficient allocation of resources. In an economy with financial frictions, the informal firm is likely to face higher external funding costs than the formal firm. These financial market distortions ameliorate the misallocation caused by labor market distortions.

This argument ignores the fact that entrepreneurs can overcome financial constraints through saving. If there were financial frictions and no labor market distortions, then small informal unproductive firms would see no reason to save because it is not optimal for them to grow. However, with labor market distortions, labor costs faced by small unproductive firms would decrease, and it could potentially be optimal for these firms to save in order to acquire capital (which complements labor).

Thus, in a context of pre-existing distortions, firm saving can create an additional inefficiency by allowing small informal firms to undo financial restrictions and therefore, capture more resources (labor and capital) than they would otherwise. Note that without those pre-existing labor distortions this inefficiency cost of savings would not be such. Increasing aggregate productivity by reducing misallocation requires reducing pre-existing distortions rather than preventing firms from saving, which is probably unfeasible.[31]

The additional misallocation cost of firm saving depends critically on the actual amount of capital allocated to small informal and unproductive firms and on the shape of the demand of capital of these firms. The evidence suggests this is not a first-order problem, however. In order to estimate the size distribution of capital in the economy an economic census is needed that covers all firms in that economy. To the best of our knowledge, the only country in the region that has such data is Mexico. Busso, Fazio and Levy (2012) used Mexico's 2008 economic census and found that 90 percent of establishments have less than five employees and employ 38 percent of the economy's labor but only 13 percent of the capital. On the other hand, larger firms with 50 or more employees employ more than 70 percent of the economy's available capital. In addition, data from the National Survey of Micro-Enterprises for Mexico confirms that small

[31] In addition, were these small family firms somehow prevented from saving it is not clear that those resources would go to other firms via the financial system. More likely, household consumption would go up and aggregate saving would decrease.

firms do not use much capital: the median small firm has a stock value of capital of less than US$ 1,000. This is consistent with experimental evidence that found that small informal firms have a value of the marginal product of capital that is very high for very low levels of capital (de Mel, McKenzie and Woodruff, 2008) and decreases sharply as firms accumulate small amounts of capital (McKenzie and Woodruff, 2006).

This result suggests that, even though distortions are large and can misallocate resources, thereby causing large productivity losses in developing countries (Hsieh and Klenow, 2009; Restuccia and Rogerson, 2008), they do not seem to increase because of firm saving. The reason is that small firms are labor intensive and do not demand much capital; therefore they do not capture a large share of saving or physical capital of the economy.

8. Policy Implications: Foster Productivity and Reduce Financial Frictions

Two general policy implications are derived from this paper. First, when considering policies that promote savings, policymakers should not forget economic reforms that foster productivity growth. This paper showed that episodes of fast TFP growth were accompanied by increases in aggregate saving rate and GDP growth while episodes of savings growth without TFP growth did not lead to GDP growth. This can be related to the literature on growth accelerations and reforms (Sachs and Warner, 1995; Hausmann, Pritchett and Rodrick, 2005; and Jones and Olken, 2008). This literature has identified structural breaks in economic growth and documented how variables correlate with growth accelerations that followed afterwards. Importantly, they have provided evidence that large-scale economic reforms are statistically significant predictors of these sustained growth accelerations and that early stages of growth are driven by TFP growth. This can be associated with the simple model presented in the paper in which exogenous changes to TFP are able to capture the main dynamics in the time series of savings. Unfortunately, productivity growth has been elusive in Latin America. Pagés (2010) discussed policies to promote productivity growth in the region, including those aimed at reducing misallocation of resources, promoting competition, and fostering firm innovation.

Second, this paper showed that since aggregate productivity is a weighted average of individual firm productivity, who gets to produce and how much affects the resulting aggregate productivity growth and is therefore crucial in terms of savings incentives. In particular, severe financial market frictions would slow down the dynamics of productive firms significantly, as they need to save before they can grow. While this results in higher savings by productive firms, it also results in losses due to misallocation, lower TFP growth, and lower aggregate saving rates.

Thus, policies to address the underlying causes of financial frictions can help improve capital allocation and entrepreneurial talent, thereby increasing investment returns and savings incentives. Buera and Shin (2013) have also pointed that underdeveloped financial markets can act as a bottleneck on the growth effects of reforms that trigger TFP growth by reducing inefficiencies on resource reallocation. Hence, reforms aimed at improving resource allocation are likely to have a stronger and faster effect on growth if they are accompanied by parallel measures aimed at reducing financial frictions. Additionally, recent experiments by Midrigan and Xu (2014) and Dabla-Norris et al. (2015) showed that alleviating financial constraints, ameliorating asymmetric information, and lowering transaction costs could have a quantitatively significant effect on the saving rate. Precisely how this is accomplished is the subject of vast empirical literature, some of which is discussed in Chapter 11 of Cavallo and Serebrisky (2016).

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Appendix A. Episodes

A1. Data

The data used in this paper to identify TFP and savings episodes come from Penn World Table (PWT) 8.0 collected by Feenstra et al. (2015), "The Next Generation of the Penn World Table," available for download at www.ggdc.net/pwt. In particular, we used two files: the main file "pwt80.xlsx"; and the National Accounts data file "na_data_pwt.xlsx." The former was used in the growth accounting computations. The latter was the main source for the identification of episodes.

The dataset is composed of a panel of 167 countries between 1950 and 2011. It is noteworthy that despite the fact that the national accounts data file covers more countries, we kept only those with available data in the main release of PWT in order for the analysis to remain consistent across exercises.

Saving rates are computed from the file "na_data_pwt.xlsx" as $S = 1 - c - g$, where c is the ratio of household consumption to real GDP at constant national 2005 prices and g is the ratio of government consumption to real GDP at constant national 2005 prices. The current account balance share is computed as the difference of saving rate and investment share.

A.2 Episode Identification (Methodology): TFP and Savings

A.2.1 TFP Episodes

A.2.1.1 Description of algorithm conditions

An episode of acceleration in the log of TFP, Ln(TFP), starts in t if the following three conditions are satisfied jointly:

$$(1)\ \text{Ln}(TFP_{t+\Delta}) - \text{Ln}(TFP_t) > \Omega^{NA}$$

$$(2)\ \frac{\sum_{j=t+\Delta}^{\overline{T}} \text{Ln}(TFP_j)}{\overline{T} - (t+\Delta) + 1} > \alpha^{NA}\text{Ln}(TFP_{t+\Delta}); \text{where } \overline{T} \text{ is the end of the sample}$$

$$(3) \text{Ln}(TFP_t) > \theta^{NA}\ \frac{\sum_{j=T_0}^{t} \text{Ln}(TFP_j)}{t - T_0 + 1}; \text{where } T_0 \text{ is the beggining of the sample}$$

Condition (1) identifies the beginning of the episode as well as the minimum size of the jump in Ln(TFP) at t, through Ω^{NA}, and Δ establishes the minimum window of time of interest, which in our case is a decade (see below).

Condition (2) restricts the analysis only to the cases in which the jump in Ln(TFP) in the long run, defined as the average Ln(TFP) between $t + \Delta$ and Ln(TFP) at the end of the sample, minus the initial Ln(TFP) at t, is greater than α^{NA} times the level of TFP at the end of the decade following the beginning of the episode. In other words, this condition omits those cases in which the jump was not permanent.

Condition (3) restricts the analysis only to the cases in which Ln(TFP) surges have been a "true increase" and not just the recovery from a previous fall in Ln(TFP).

A.2.1.2 Calibration

We calibrate $\Omega^{NA} = 0.34$, roughly equal to Japan's Ln(TFP) jump in the 1960s, which is a well-known episode of TFP increase (see Chen, Imrohoroglu and Imrohoroglu, 2006). Δ=10 restricts the analysis to episodes that took place fast, that is, within a decade. $\alpha^{NA} = 1$ implies that average Ln(TFP) after Δ must have kept at least Ω^{NA} times greater than Ln(TFP) at the beginning of the episode. This study calibrates θ^{NA} so that the algorithm eliminates recoveries identified without (3). We set this parameter $\theta^{NA} = 1$, after checking that clear episodes of recoveries in Ln(TFP) were removed from the pool selected.

A.2.2 Episodes of Savings Surges

A.2.2.1 Description of algorithm conditions

An episode of surge in the saving rate S starts in t if the following three conditions are satisfied jointly:

$$(1)\ S_{t+\Delta^S} - S_t > \Omega^S$$

$$(2)\ \frac{\sum_{j=t+\Delta^S}^{\overline{T}} S_j}{\overline{T} - (t + \Delta^S) + 1} - S_t > \alpha^S \Omega^S; \text{where } \overline{T} \text{ is the end of the sample}$$

$$(3) S_t > \theta^S\ \frac{\sum_{j=T_0}^{t} S_j}{t - T_0 + 1}; \text{where } T_0 \text{ is the beggining of the sample}$$

The parameters were calibrated as follows: (Ω^S=0.07), ($\Delta^S = 10$), ($\alpha^S = 1$) and ($\theta^S = 1$). Condition (1) identifies the beginning of the episode as well as the minimum size of the jump in S at t, through Ω^S, and Δ^S establishes the minimum window of time that we are interested in.

Condition (2) restricts the analysis only to the cases in which the jump in S in the long run, defined as the average S between $t + \Delta^S$ and S at the end of the sample, minus the initial S

at t , is greater than α^S times the minimum size of the jump. In other words, this condition omits those cases in which the jump was not permanent.

Condition (3) restricts the analysis only to the cases in which S surges have been a "true increase" and not just the recovery of a previous fall in S.

A.2.2.2 Calibration

We calibrate Ω^S = 0.07, roughly two-thirds of Japan's S jump in the 1960s–1970s. Δ^S=10 restricts the analysis to episodes that took place fast, that is, within a decade. $\alpha^S = 1$ implies that average S after Δ^S must have kept at least Ω^S times greater than S at the beginning of the episode. Calibrate θ^S=1 so that the algorithm eliminates recoveries of the saving rate from previous falls.

Table A.1.1 Fifteen $Ln(TFP)$ Episodes with National Accounts Data

Country			Change in Ln(TFP)	Change in Ln(GDP) per capita	Savings at t	Change in Savings Rate	Change in Investment Share	Change in Current Account Balance Share	Change in Net Export Share
Armenia	2000	2010	0.63	0.78	-0.04	0.13	0.11	0.02	0.03
Brazil	1951	1961	0.39	0.46	0.17	-0.02	-0.05	0.03	0.04
China	1982	1992	0.48	0.82	0.41	-0.06	-0.08	0.01	-0.01
Cyprus	1975	1985	0.47	0.74	0.19	0.06	0.06	-0.01	0.06
Greece	1956	1966	0.45	0.60	0.11	0.13	0.15	-0.02	-0.04
Israel	1965	1975	0.43	0.77	0.30	-0.20	-0.02	-0.19	-0.05
Italy	1960	1970	0.38	0.55	0.17	0.04	0.02	0.02	-0.01
Japan	1956	1966	0.36	0.76	0.07	0.11	0.10	0.01	-0.01
Malta	1966	1976	0.63	0.94	-0.36	0.56	-0.26	0.82	0.58
Mozambique	1996	2006	0.35	0.56	-0.01	0.07	-0.03	0.10	0.12
Poland	1994	2004	0.35	0.45	0.15	0.03	0.05	-0.02	-0.03
Portugal	1958	1968	0.43	0.62	0.15	0.03	0.04	0.00	0.00
Spain	1955	1965	0.37	0.59	0.22	0.06	0.06	0.00	0.00
Sri Lanka	1972	1982	0.34	0.32	0.31	-0.12	0.06	-0.18	-0.04
Thailand	1965	1975	0.35	0.66	0.18	0.01	0.04	-0.03	-0.04
Mean			0.43	0.64	0.13	0.06	0.02	0.04	0.04
Std. Dev.			0.09	0.16	0.18	0.17	0.10	0.23	0.16
Median			0.39	0.62	0.17	0.04	0.04	0.00	-0.01
Minimum			0.34	0.32	-0.36	-0.20	-0.26	-0.19	-0.05
Maximum			0.63	0.94	0.41	0.56	0.15	0.82	0.58

Notes: The parameters are (Ω^{NA}=0.34), (Δ= 10), ($\alpha^{NA} = 1$), and ($\theta^{NA} = 1$). The change is computed as the difference between the last and first values of the episode within a decade.

Table A.1.2 Twenty-two Savings Episodes with National Accounts Data

	Country			Change in Ln(TFP)	Change in Ln(GDP) per capita	Savings at *t*	Change in Savings rate	Change in Investment Share	Change in Current Account Balance Share	Change in Net Export Share
High TFP Growth	Malta	1972	1982	0.68	0.87	-0.16	0.44	-0.03	0.47	0.55
	Japan	1956	1966	0.36	0.76	0.07	0.11	0.10	0.01	-0.01
	Malaysia	1962	1972	0.28	0.51	0.29	0.10	0.03	0.07	0.07
	Singapore	1965	1975	0.24	0.87	0.18	0.14	0.13	0.01	0.03
	Egypt	1967	1977	0.24	0.45	-0.07	0.07	0.09	-0.02	-0.07
	Austria	1959	1969	0.18	0.42	0.13	0.07	0.05	0.02	-0.01
	Costa Rica	1963	1973	0.18	0.40	-0.17	0.12	0.03	0.09	0.01
	Barbados	1966	1976	0.15	0.40	-0.41	0.40	0.08	0.32	0.11
	China	1961	1971	0.13	0.33	0.33	0.07	0.16	-0.09	-0.02
	India	1984	1994	0.13	0.33	0.16	0.09	0.03	0.05	-0.02
	Luxembourg	1990	2000	0.10	0.36	0.37	0.08	0.01	0.07	0.09
	Qatar	1986	1996	0.10	0.05	0.49	0.08	0.13	-0.05	-0.14
	Mean			0.23	0.48	0.10	0.15	0.07	0.08	0.05
	Std. Dev.			0.16	0.24	0.26	0.13	0.06	0.16	0.17
	Median			0.18	0.41	0.15	0.09	0.06	0.04	0.00
	Minimum			0.10	0.05	-0.41	0.07	-0.03	-0.09	-0.14
	Maximum			0.68	0.87	0.49	0.44	0.16	0.47	0.55
Low TFP Growth	Chile	1975	1985	0.05	0.18	0.18	0.09	0.00	0.09	0.08
	Ireland	1979	1989	0.05	0.19	0.09	0.12	-0.08	0.20	0.10
	Kenya	1960	1970	0.03	0.03	0.02	0.08	0.09	-0.01	-0.01
	Thailand	1977	1987	0.03	0.41	0.20	0.08	-0.04	0.12	0.10
	Bahrain	1986	1996	0.01	0.16	0.30	0.12	-0.03	0.16	0.14
	Ecuador	1984	1994	-0.02	0.06	0.14	0.09	-0.02	0.11	0.06
	Senegal	1984	1994	-0.03	-0.08	0.00	0.07	0.00	0.08	0.09
	Namibia	1982	1992	-0.14	-0.12	0.06	0.12	-0.01	0.13	0.14
	Rwanda	1985	1995	-0.49	-0.30	-0.35	0.12	-0.10	0.22	0.41
	Jordan	1981	1991	-0.58	-0.36	-0.17	0.14	-0.21	0.35	0.52
	Mean			-0.11	0.02	0.05	0.10	-0.04	0.15	0.16
	Std. Dev.			0.23	0.24	0.19	0.02	0.08	0.10	0.17
	Median			-0.01	0.05	0.07	0.10	-0.03	0.12	0.10
	Minimum			-0.58	-0.36	-0.35	0.07	-0.21	-0.01	-0.01
	Maximum			0.05	0.41	0.30	0.14	0.09	0.35	0.52

Notes: The parameters are (Ω^S=0.07), (Δ^S= 10), ($\alpha^S = 1$), and ($\theta^S = 1$). The change is computed as the difference between the last and first values of the episode. Episodes whose change in Ln(TFP) equals or exceeds 0.10 are classified as "high TFP growth" episodes.

Table A.1.3 Eleven GDP Per Capita Episodes as Defined by the Commission on Growth and Development (2008) as Percent of Contribution to GDP

Country			Change in Ln(GDP per capita)	Change in Ln(TFP)	Change in Ln(Capital per capita)	Change in Ln(Labor per capita)
Brazil	1950	1980	100	93.34	29.44	-22.79
China	1961	2005	100	52.18	43.82	4
Hong Kong	1960	1997	100	36.33	49.99	13.68
Indonesia	1966	1997	100	44.27	59.41	-3.68
Japan	1950	1983	100	50.81	49.6	-0.41
Korea, Rep.	1960	2001	100	38.54	51.05	10.4
Malaysia	1967	1997	100	45.37	54.75	-0.12
Malta	1963	1994	100	65.3	24.79	9.91
Singapore	1967	2002	100	28.11	69.13	2.75
Taiwan	1965	2002	100	26.25	69.15	4.6
Thailand	1960	1997	100	46.33	66.63	-12.97
Mean			100	47.89	52.1	0.49
Std. Dev.			0	18.7	14.21	10.66
Median			100	45.37	52.9	2.75
Minimum			100	26.25	24.79	-22.79
Maximum			100	93.34	69.15	13.68

Notes: These episodes are taken directly from the Commission on Growth and Development (2008: 20, Table 1). Botswana and Oman were excluded due to data unavailability. These results correspond to the main release of the PWT data, except for TFP. The TFP data were constructed in accordance with the PWT production function (Cobb–Douglas), assuming constant participation of labor throughout the time dimension. This parameter is the average of available data. The change is computed as the difference between the last and first values of the episode.

Appendix B. Sources for Simulation-Based Saving Rates

For Japan, the original series of TFP growth came from Hayashi and Prescott (2002), who made certain adjustments to the Japanese National Income Accounts (NIA). In constructing the time series for capital, the depreciation rates found by Hayashi (1989) were used. The data for effective capital tax rates were obtained from Mendoza et al. (1994). The data on population growth and government consumption came from the NIA.

For Mexico and Chile, the capital series were constructed following Bergoeing et al. (2002) and Kehoe and Meza (2011). In particular, the initial value for the capital stock was taken from Bergoeing et al. (2002) for Chile and from Kehoe and Meza (2011), respectively. Then, the nominal gross fixed capital formation series was added to the inventory series and deflated using the GDP deflator (all three series from the International Financial Statistics, IFS, database of the

International Monetary Fund, IMF), and a depreciation of 5 percent was used to construct a time series of capital starting from the initial values mentioned before. Annual hours worked were taken from the Conference Board Total Economy Database. With these two variables (capital and labor), and GDP from the IMF's IFS, we computed TFP using a capital-share parameter of 0.3. The data for population growth corresponds to the growth of the working-age population (15–64 years) which comes from the World Bank's World Development Indicators. Government consumption as a share of GDP comes from the World Bank and includes all government current expenditure for purchases of goods and services, including compensation of employees, as well as most expenditure on national defense and security, excluding government military expenditure that is part of government capital formation.

Appendix C. World Bank Enterprise Survey Data Appendix

Sample. The WBES is a firm-level survey answered by business owners and managers. Originally, these data provided information for firms in 41 countries in Latin America, Europe, and Asia. However, owing to information availability of some questions, the sample was reduced. For the analysis, we use mainly Latin American data with Germany as a benchmark economy. We only use information for countries with a sample size larger than 200 observations with non-missing information. Our sample included the following countries (samples sizes in parentheses): Argentina (1,439), Bolivia (551), Colombia (1,086), Mexico (1,203), Panama (401), Paraguay (571), Uruguay (700), Venezuela (291), Chile (1,403), Ecuador (659), El Salvador (593), Honduras (566), Guatemala (584), Nicaragua (525), Brazil (2,563), and Germany (811).

Size distribution of firms. There were relatively few small firms in our sample. Whereas small firms with 5 or fewer employees represented around 6 percent of all firms in all the countries, medium–small firms with between 6 and 10 employees represented 11 percent. The largest group of firms in this data comprised firms with between 11 and 50 employees; they represented around 40 percent of all the firms. Finally, 14 percent of surveyed firms had between 51 and 100 employees and 29 percent had more than 100 employees. The size categories were defined as less than 6 employees, between 6 and 10 employees, between 11 and 15 employees, between 16 and 25 employees, between 26 and 50 employees, between 51 and 75 employees, between 76 and 100 employees, between 101 and 151 employees, between 151 and 250 employees, between 251 and 500 employees, and more than 500 employees.

Reweighting. The size distribution of firms within countries does not always match the real size distribution; in some cases, the WBES size distribution is comparable to that observed in the economic censuses. Because size is correlated with some variables of interest, we keep the size distribution constant by reweighting observations so that each country had the average size distribution of the sample.

Survey. The survey was implemented in each country in different years between 2003 and 2014. The questionnaires, even when they shared common features, were not precisely the same for all the countries. In particular, the question's structure in Organisation for Economic Co-operation and Development countries differs ostensibly from that of Latin American countries.

Measurement of firms' savings. The survey asked respondents to estimate the proportion of the establishment's total purchase of fixed assets/working capital that was financed from each of the following sources: i) internal funds or retained earnings, ii) owners' contribution or issued new equity shares, iii) borrowed from banks, iv) borrowed from non-bank financial institutions, v) purchased on credit from suppliers and advances from customers, and vi) others. The survey asked for fixed assets and defined them directly in the question as machinery, vehicles, equipment, land, or buildings. We define firm savings as the share of fixed assets financed with internal funds or retained earnings.

Appendix D. Robustness to Table 1

Dependent Variable: Share of Fixed Assets Financed with Firms' Savings	Sample			
	With Credit Constraints	With Credit Constraints but Applied for Credit	With Credit Constraints	With Credit Constraints but Applied for Credit
Panel A: With a line of credit				
Firm Productivity	0.0204**	0.0690**	0.0184*	0.0662**
	(0.0088)	(0.0259)	(0.0091)	(0.0247)
Panel B: With an overdraft facility				
Firm Productivity	0.0186	0.0207	0.0126	0.0204
	(0.0153)	(0.0176)	(0.0145)	(0.0187)
Panel C: Access to finance is not an obstacle to operations				
Firm Productivity	0.0126	0.0184**	0.0091	0.0160**
	(0.0097)	(0.0080)	(0.0091)	(0.0078)
Year Fixed Effect	Yes	Yes	Yes	Yes
Size Fixed Effect	Yes	Yes	Yes	Yes
Country Fixed Effect	No	No	Yes	Yes