American Economic Journal: Macroeconomics 2017, 9(3): 147–185
https://doi.org/10.1257/mac.20160307

Productivity Growth and Capital Flows: The Dynamics of Reforms†

By Francisco J. Buera and Yongseok Shin*

Why doesn't capital flow into fast-growing countries? Using a model with heterogeneous producers and underdeveloped domestic financial markets, we explain the joint dynamics of total factor productivity (TFP) and capital flows. When a large-scale economic reform removes preexisting idiosyncratic distortions in a small open economy, its TFP rises, driven by efficient reallocation of economic resources. At the same time, because of the domestic financial frictions, saving rates surge but investment rates respond only with a lag, resulting in capital outflows. The dynamics of TFP, capital flows, and idiosyncratic distortions in the model are consistent with what is observed during growth acceleration episodes, which often follow large-scale economic reforms. (*JEL* E21, E22, F21, F32, O16, O47)

Standard economic theory predicts that capital should flow into countries experiencing a sustained increase in total factor productivity (TFP). The evidence from developing countries over the last three decades contradicts this prediction. If anything, capital tends to flow out of countries with fast-growing productivity (Prasad, Rajan, and Subramanian 2007; Gourinchas and Jeanne 2007). To better understand this finding, we focus on the most salient episodes of growth accelerations in the data. The fact that capital flows out even during such episodes is the most puzzling and hence the most revealing about the economic forces not captured by the standard theory. Upon closer inspection, we observe that pronounced accelerations in TFP often follow economic reforms, and the accompanying capital outflows reflect a surge in aggregate saving and a more muted response of aggregate investment.

The goal of our paper is to explain this phenomenon. To this end, we analyze a quantitative framework where growth-enhancing reforms generate an endogenous

* Buera: Federal Reserve Bank of Chicago, 230 South La Salle Street, Chicago, IL 60604 (email: francisco.buera@chi.frb.org); Shin: Washington University in St. Louis, CB 1208, 1 Brookings Drive, St. Louis, MO 63130, Federal Reserve Bank of St. Louis, and NBER (email: yshin@wustl.edu). We thank Chung-Han Kim, Dirk Krueger, Bob Lucas, Albert Marcet, Alberto Martin, and Guido Sandleris for their insightful discussions. Maria Arias and Brett Fawley provided superb research assistance. We gratefully acknowledge the financial support of the National Science Foundation (grants SES-0820318 and SES-0946647) and the Consortium on Financial Systems and Poverty at the University of Chicago. Buera was also supported by the Kauffman Foundation (grant 20090598). We have no relevant or material financial interests that relate to the research described in this paper. The views expressed here do not necessarily reflect the position of the Federal Reserve Banks of Chicago and St. Louis or the Federal Reserve System.

† Go to https://doi.org/10.1257/mac.20160307 to visit the article page for additional materials and author disclosure statement(s) or to comment in the online discussion forum.

joint dynamics of TFP and capital flows. The nature of this joint dynamics is shown to depend primarily on the degree of frictions in the domestic financial markets.

Our model has three key ingredients. First, individuals choose whether to operate an individual-specific technology (i.e., entrepreneurship) or to become a wage worker. This occupation choice allows for endogenous entry and exit of heterogeneous producers, which are important channels of resource reallocation. Second, we incorporate endogenous collateral constraints on capital rental. Such financial frictions are not only a source of misallocation themselves, but they also slow down the process of resource reallocation among heterogeneous producers. Third, we model large-scale, growth-enhancing reforms as the removal of preexisting idiosyncratic distortions (e.g., sector-specific and size-dependent taxes and subsidies). Such reforms lead to a process of efficient reallocation of production factors, which is intermediated through the underdeveloped domestic financial markets. This modeling choice is supported by available micro-level data on the evolution of idiosyncratic distortions during growth accelerations that followed economic reforms.[1]

We use our model to study the transitional dynamics of a small open economy after such a reform. The initial condition for the transition is the stationary equilibrium of an open economy that (i) has idiosyncratic distortions and (ii) has poorly functioning domestic financial markets. It is characterized by rampant misallocation of resources and hence by a low level of aggregate TFP.

Once the reform is implemented and all idiosyncratic distortions are eliminated at once, aggregate TFP rises endogenously, mirroring the more efficient reallocation of economic resources.[2] More important, capital flows out of this small open economy, driven by disparate dynamics of aggregate investment and saving.

After the reform, investment rates initially fall, and then rise sluggishly. This results from the downsizing and exit of entrepreneurs who lose their subsidy, and from the domestic capital market frictions constraining and slowing down the entry and expansion of productive entrepreneurs.

On the other hand, saving rates increase following the reform and then decline slowly. The initial increase is driven by entrepreneurs' permanent income consumption/saving behaviors and self-financing motive for saving. First, the income of productive and wealthy entrepreneurs is particularly and temporarily high right after the reform because factor prices (i.e., wages) are temporarily low before they rise to the new steady-state level. Thus, productive and wealthy entrepreneurs take advantage of the temporary low wages and high profits presented by the reform, and save a higher fraction of their income in a manner consistent with the permanent income theory. Second, individuals who have high entrepreneurial productivity but relatively little wealth choose high saving rates, so that they can overcome the collateral constraints over time and self-finance their profitable business. However, self-financing alone cannot explain why saving grows faster than investment, because entrepreneurs do have access to external finance. That is, they can invest more than they save, with the

[1] The importance of idiosyncratic distortions in understanding the low TFP of developing countries is discussed by Hsieh and Klenow (2009) and Bartelsman, Haltiwanger, and Scarpetta (2009). Earlier contributions include Hopenhayn and Rogerson (1993); Guner, Ventura, and Xu (2008); and Restuccia and Rogerson (2008).

[2] The endogenous TFP result was the main focus of a related paper of ours, Buera and Shin (2013), which explored the transition dynamics for *closed* economies.

collateral constraints limiting the magnitude of this leverage. Self-financing, nevertheless, restricts the excess investment over saving at the individual entrepreneur level. Overall, this saving behavior of entrepreneurs explains the high aggregate saving rates in the early stages of the post-reform transition.

In summary, our model generates a strong positive correlation between TFP and saving but a much weaker one between TFP and investment, consistent with the data from the growth accelerations. We argue that, in order to explain why capital may flow out of countries with fast TFP growth, it is important to consider a framework that allows for rich endogenous dynamics of TFP, investment, and saving. The development of such a framework is the main contribution of our paper.

To highlight the role of domestic financial frictions, we also consider an alternative sequencing of economic reforms. In our main exercise described above, the reform consists of a single component: the removal of idiosyncratic distortions. One can think of a farther-reaching reform package that not only removes idiosyncratic distortions but also substantially improves the local financial institutions. With this broader reform, TFP will now increase not only because of the removal of idiosyncratic distortions but also because of the improved financial markets. At the same time, capital now flows *into* this economy. The main reason is that the improved local financial markets expedite the entry and expansion of productive entrepreneurs. As a result, aggregate investment now increases strongly even in the early stages of the post-reform transition. On the other hand, saving rates do not increase as much as in the main exercise for two reasons. The transition is much faster with the improved financial markets, and, hence, the permanent income saving effect is less strong. In addition, entrepreneurs can now obtain more external financing, and accordingly have weaker self-financing motives for saving. Overall, investment outstrips saving as TFP rises, and capital flows in from overseas to meet this excess demand for capital.

Given the different results we obtain in the two exercises, it is natural to ask which is a more accurate description of developing economies' reform episodes. In addition to the inferred evidence in the form of the correlation between TFP growth and capital flows, a perusal of the reform episodes suggests the prevalence of the sequencing in our first exercise. The reduction of sector-specific or size-dependent taxes and subsidies preceded domestic financial market reforms in the countries that are the most relevant for our analysis. In fact, the former is often referred to as "first-generation" reforms, while domestic financial institutions belong to the domain of "second-generation" reforms (Camdessus 1999). More broadly, the reform of domestic financial institutions in emerging economies surfaced onto the center stage of international policy debates only after the East Asian and Russian financial crises of the late 1990s, with the realization that the gains from economic liberalization remain elusive without a developed local financial sector (Mishkin et al. 2003; Stulz 2005; Kaminsky and Schmukler 2008; Obstfeld 2008).

Contribution to the Literature.—The earlier literature on international capital flows focused on the Lucas puzzle—the small volume of capital flows from rich to poor countries. This fact can be explained by the overall lower productivity in poor countries (Lucas 1990) or their higher relative cost of investment (Caselli and Feyrer 2007). Gertler and Rogoff (1990) and Boyd and Smith (1997) developed theories demonstrating how frictions in local capital markets can interact with international capital markets and cause capital to flow from poor to rich countries. Caballero, Farhi, and Gourinchas (2008) and Mendoza, Quadrini, and Ríos-Rull (2009) emphasize this interaction between local and international financial markets to explain "global imbalances," using models where the primary role of financial markets is to facilitate consumption smoothing. Castro, Clementi, and MacDonald (2004) also analyze how domestic financial market imperfections can determine the direction of international capital flows between rich and poor countries.

The goal of our paper is to explain why capital does not flow into countries with fast-growing TFP (Prasad, Rajan, and Subramanian 2007; Gourinchas and Jeanne 2007). While the models in the aforementioned literature can explain the negative correlation between capital outflows and income *levels* across countries, they cannot generate capital outflows during a spell of exogenous acceleration in TFP. In comparison, we provide a framework that allows for rich joint dynamics of endogenous TFP, investment, and saving. In addition, our mechanism is starkly different from those in the literature that rely on interest rate differentials between financially developed and financially underdeveloped economies to generate poor-to-rich capital flows. In our exercises, we start with an already open economy that takes the constant world interest rate as given.

More recently, a number of researchers have formulated and addressed a closely-related puzzle: Capital tends to flow out of countries that are fast-growing in terms of *income per capita*. Carroll, Overland, and Weil (2000) use habit formation in preferences to explain this in an endowment economy setup. Aguiar and Amador (2011) provide a political economy explanation for why the governments of rapidly growing countries accumulate net foreign assets rather than liabilities. Angeletos and Panousi (2011) and Sandri (2014) focus on the market incompleteness in sharing entrepreneurial risk, and in this sense are closely related to the underlying mechanism of Caballero, Farhi, and Gourinchas (2008), Mendoza, Quadrini, and Ríos-Rull (2009), Carroll and Jeanne (2009), and Benhima (2013).

The paper by Song, Storesletten, and Zilibotti (2011) deserves a more detailed discussion. It studies the best-known example of a country that grew fast and amassed a huge amount of foreign assets during the past two decades—China. The model has two sectors. When the private, entrepreneurial sector that is largely self-financed expands, the fully externally financed, state-owned sector shrinks and demands less capital. As a result, the supply of assets in the domestic financial market dwindles, whereas the demand for assets by workers who save for life-cycle reasons does not. This excess demand for assets leads to the purchase of foreign assets and capital outflows. Another mechanism that generates excess saving over investment is the assumption that would-be entrepreneurs spend half their working lives saving up net worth before they can start investing in their business.

Our paper complements this recent literature by addressing the experiences of a broader set of developing countries, where the impact of economic reforms was intermediated through underdeveloped local financial markets. Our analysis highlights the disparate forces driving the post-reform transition dynamics of endogenous TFP, investment, and saving. What sets our paper apart more clearly is the aggregate saving, which is driven by entrepreneurs' permanent income and precautionary saving behavior, as well as their self-financing motive. The interplay of the distinct saving motives generates realistic aggregate saving dynamics over a time horizon commensurate with growth acceleration episodes, without relying on exogenous sectoral differences in external financing dependence or a restrictive occupation structure.

Finally, Buera and Shin (2013) is a closely related paper that also explores the effect of resource misallocation and financial frictions on transitional dynamics. However, it analyzes a closed-economy model, so the saving and investment rates are tied together and capital flows cannot be considered.

I. Motivating Facts

In this section, we show the joint dynamics of capital outflows—i.e., the difference between saving and investment—and TFP for countries undergoing sustained growth accelerations. We also document that the occurrence of sustained accelerations is associated with major economic reforms.

In Figure 1, we show the average behavior of the difference between saving and investment rates and of the TFP across the sustained growth acceleration episodes identified using the methodology of Hausmann, Pritchett, and Rodrik (2005).[3] Because most developing countries started liberalizing their capital accounts in the 1980s, we divide the sample into pre- and post-1980 periods, with 33 and 22 sustained growth accelerations, respectively. In all panels, the horizontal axis is years, and year 0 corresponds to the statistically identified beginning of each sustained acceleration. The unit on the vertical axes of the top panels is the difference between saving and investment rates, in point deviations from the average over years -5 through -1. The vertical axes of the bottom panels are TFP normalized by its average over years -5 through -1. The left column shows the time series averaged across the 33 sustained accelerations before 1980, and the right column is the average across the 22 episodes after 1980. The dashed lines are the 5 percent and 95 percent error bands.

In the pre-1980 period, sustained growth accelerations are characterized by fast TFP growth and also by negligible differences between saving and investment rates. The tight correlation between saving and investment rates affirms the well-known result of Feldstein and Horioka (1980) in our sample of sustained accelerations, and is consistent with the view that international capital mobility was limited in this period.[4]

[3] In Hausmann, Pritchett, and Rodrik (2005), a growth acceleration starts in year t only if the following conditions are met: (i) the average growth rate in the ensuing 7 years (years t through $t+6$) is above 3.5 percent and is at least 2 percentage points higher than in the preceding 7 years (years $t-7$ to $t-1$); and (ii) the output per capita in years t through $t+6$ is above the previous peak. If more than one contiguous year satisfies these conditions, the start of the growth acceleration is chosen to be the one for which a trend regression with a break in that year provides the best fit among all eligible years, in terms of F-statistics. A growth acceleration is called *sustained* if the average growth rate in the following decade (years $t+7$ through $t+16$) is above 2 percent. We apply their methodology to an updated sample (Penn World Tables 8.0).

[4] It is also consistent with the de jure measures in Abiad, Detragiache, and Tressel (2010). Only 10 in the sample of 72 countries liberalized their capital account before 1973, and 4 did so between 1973 and 1979.

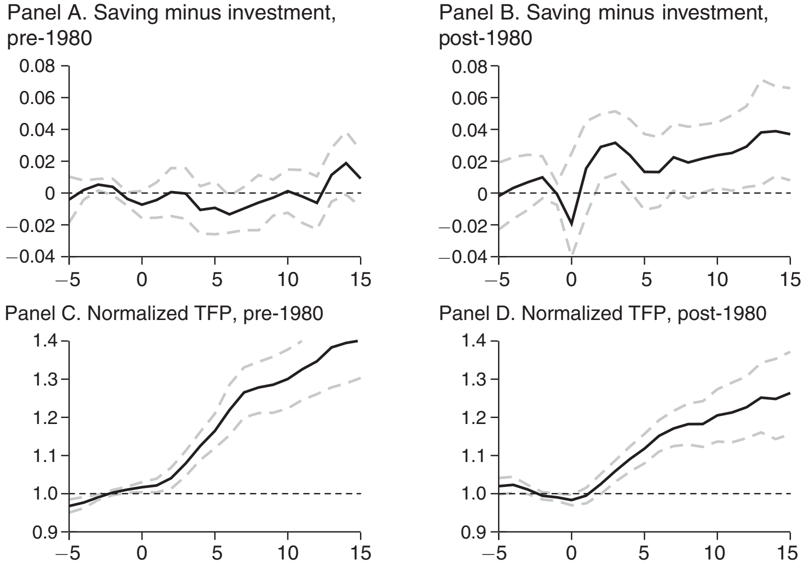

Figure 1. Capital Outflow and TFP during Sustained Growth Accelerations

Notes: Panels A and C show, respectively, the average of saving minus investment rates and TFP over the 33 sustained accelerations before 1980. Panels B and D show the average over the 22 episodes after 1980. The horizontal axis is years, with year 0 as the statistically identified beginning of each episode. Saving minus investment rates are in point deviations from the average over years −5 through −1, and TFP is normalized by the average over the same period. Dashed lines are 5 percent and 95 percent error bands.

In the post-1980 period, with more liberalized cross-border capital flows, saving and investment rates do not move in lockstep during sustained accelerations. Saving rates rise strongly in the early stages of the acceleration episodes, while investment rates lag behind. (In Figure 2, we show saving and investment rates separately.) The average difference between saving and investment rates (i.e., the ratio of capital outflows to GDP) is significantly greater than zero in years 2–4 and 9–15 at the one-sided 5 percent level. This puzzling combination of capital outflows and TFP growth during the post-1980 sustained accelerations has received little attention in the literature, with the notable exception of Prasad, Rajan, and Subramanian (2007).

What causes sustained growth accelerations? This question was explored by Hausmann, Pritchett, and Rodrik (2005). It finds that "external shocks tend to produce growth accelerations that eventually fizzle out, while economic reform is a statistically significant predictor of growth accelerations that are sustained."[5] To illustrate the association between economic reforms and growth accelerations, we compute the fraction of sustained and temporary accelerations whose start pre-dates or post-dates an economic reform by five or fewer years. A reform episode is a discrete increase in the openness index of Sachs and Warner (1995), as updated by Wacziarg and Welch (2003), or a change in the credit control component of the financial reform index of Abiad, Detragiache, and Tressel (2010). The openness

[5] See Table 12 in Hausmann, Pritchett, and Rodrik (2005). We reproduce these results for our expanded and updated sample in Appendix B.

Table 1—Economic Reform and Post-1980 Accelerations

Acceleration type	Fraction preceded by reform	Fraction followed by reform
Sustained	0.55	0.40
Temporary	0.46	0.17

Source: Authors' calculations

index largely reflects tariffs, and the credit control refers to governments' interference in credit allocation toward "priority" sectors. In this context, a reform measured from these indices can be considered as a (partial) removal of distortions that are sector-dependent. This interpretation is supported by the available micro-level data on the evolution of idiosyncratic distortions during sustained accelerations that followed economic reforms, which we report in Section IVC.

Table 1 shows that 55 percent of sustained growth accelerations in the post 1980 period start five or fewer years after a reform, while 40 percent of them precede a reform by five or fewer years. Temporary accelerations are significantly less likely to follow or precede a reform.[6]

An important caveat is that the constructed reform indicator is far from perfect, at least for two reasons. First, the indicator is a binary variable designed to determine whether the continuous underlying policy variables crossed certain thresholds. Second, it is mostly based on de jure policy variables that may be only weakly related to the de facto policy implementation. One can easily imagine how such intrinsic limitations can lead to both false positives and false negatives.

False positives (i.e., the reform indicator going from zero to one without substantive changes in economic policy) are possible if the underlying policy variables were already close to the threshold of turning the indicator from zero to one, allowing a minor policy change to activate the indicator; or if major de jure policy changes are not implemented in practice. It is then not surprising that, as noted by Hausmann et al., in many instances the reform indicator does not Granger-cause sustained growth accelerations.[7]

On the other hand, false negatives (i.e., the indicator not picking up major economic reforms that have real consequences) are likely if a large-scale policy change nevertheless falls shy of the threshold for the indicator, because it starts from an abysmal status quo, or if important de facto policy changes are implemented unaccompanied by changes in the official rule book. One important false negative is the large-scale, pro-market reform of China in the early 1990s, which resulted in a sustained acceleration (Chow 2007).

These shortcomings can be partly addressed through in-depth historical analyses of economic reforms in developing economies. We focus on the 22 post-1980 sustained accelerations. The indicator shows reforms preceding 11 sustained

[6] As a baseline, if we pick a random year-country pair in our post-1980 sample, there is a reform in the preceding 5-year window with probability 0.31 and in the following 5-year window with probability 0.28.

[7] Another reason may be that some reforms do get reversed only after a few years, rendering a sustained acceleration improbable.

accelerations by five or fewer years, but not for 9. For the remaining two (Laos and Sudan), the indicator is not available.

As described in the online Appendix, a perusal of the economic history of the latter group of 11 countries points to well-documented important reforms—not picked up by the reform indicator—immediately preceding 7 of them (China, India, Laos, Mauritius, Taiwan, Turkey, and Vietnam). Going in the other direction, we consider one sustained acceleration with reforms to be a false positive (El Salvador 1991), because it more likely has to do with the conclusion of a prolonged civil war rather than economic reforms. All in all, we conclude that the vast majority, 17, of the 22 post-1980 sustained accelerations followed major distortion-removing reforms.[8]

In the online Appendix, we also ask whether the sustained accelerations that do and do not follow reforms are significantly different in terms of capital flows. If we only use the reform indicator, we find that only those sustained accelerations not preceded by a reform experience significant capital outflows. However, when we utilize the information from the historical narratives, we obtain the exact opposite result. Only those sustained accelerations preceded by large-scale, distortion-removing reforms have significant capital outflows.

Our empirical findings on the dynamics of capital flows and TFP during the post-1980 sustained growth accelerations are closely related to the recently documented regularity of capital flows and economic growth for developing countries in general, often referred to as the allocation puzzle. Prasad, Rajan, and Subramanian (2007) shows that the countries whose output per worker grew the fastest between 1970 and 2004 tended to run current account surplus over the same period. Gourinchas and Jeanne (2007) reports a similar pattern between TFP growth and capital outflows. Both studies further show that the capital flows and the resulting accumulation of net foreign assets are accounted for by a strong positive correlation between growth and aggregate saving, together with a relatively weaker one between growth and aggregate investment. As we show in Figure 2 of Section IVA, the behavior of the saving and investment rates during sustained growth accelerations is consistent with their findings.

To summarize, three conclusions can be drawn from the data. First, capital tends to flow out of countries experiencing fast growth in output and TFP, contrary to the prediction of standard models. Second, this pattern is more prominent in the early stages of sustained growth accelerations, which can be linked to economic reforms. Finally, the capital outflows reflect a surge in aggregate saving and a delayed rise in aggregate investment at the onset of sustained accelerations. In the rest of the paper, we provide a quantitative framework to explain this puzzling phenomenon.

[8] The other five episodes include Portugal (1984) and Spain (1983), around the time they joined the European Economic Community; and El Salvador (1991), Panama (1988), and Sudan (1993), which followed armed conflicts or civil wars. We find it unconvincing that distortion-removing economic reforms were the primary driver of these sustained accelerations.

II. Model

The key distinction of our approach from standard models is that we endogenize the TFP dynamics. We use a model with individual-specific technologies and imperfect domestic capital markets, and analyze the transition dynamics starting from an initial condition characterized by a large degree of resource misallocation.

The model is to a large extent based on the one developed in Buera, Kaboski, and Shin (2011), except that here we work with a one-sector model.[9]

Heterogeneity and Demographics.—Individuals have infinite lives and are heterogeneous in their wealth a and their entrepreneurial productivity z, with the former being chosen endogenously by forward-looking saving decisions. Individuals' productivity follows a stochastic process. In particular, an individual retains his productivity from one period to the next with probability ψ. With probability $1 - \psi$, he loses the current productivity and draws a new entrepreneurial productivity. The new draw is from a time-invariant entrepreneurial productivity distribution with cumulative density $\Omega(z)$, and is independent of his previous productivity level.

The population size of the economy is normalized to one, and there is no population growth.

Preferences.—Individual preferences are described by the following expected utility function over sequences of consumption, c_t:

$$U(c) = E\left[\sum_{t=0}^{\infty} \beta^t u(c_t)\right], \quad u(c_t) = \frac{c_t^{1-\sigma}}{1-\sigma}, \tag{1}$$

where β is the discount factor and σ is the coefficient of relative risk aversion. Leisure does not enter the utility function, and individuals supply one unit of time inelastically either as a worker or an entrepreneur.

Production Technology.—At the beginning of each period, an individual chooses whether to work for the market wage or to operate his own business. An entrepreneur with productivity z produces using capital k and labor l according to

$$zf(k,l) = zk^{\alpha} l^{\theta}, \tag{2}$$

where α and θ are the elasticities of output with respect to capital and labor and $\alpha + \theta < 1$, implying diminishing returns to scale in variable factors at the establishment level.

In addition, we introduce a corporate sector as a constant-returns-to-scale production function with full access to external financing:

$$Z_c K_c^{\alpha_c} L_c^{1-\alpha_c}, \tag{3}$$

[9] The model in Buera and Shin (2013) is also similar, but it has an exogenous, linear collateral constraint.

where K_c and L_c are the capital and labor input, and Z_c is the TFP of the corporate sector.

The corporate sector is not necessary for our results. To the contrary, we include it to limit and contain the quantitative importance of our main economic mechanism. As described in Sections IIIA–IIIC, the exogenous growth of a more productive, fully externally financed corporate sector implies that (i) the removal of idiosyncratic distortions can only be partly responsible for the TFP growth; and (ii) the demand for capital—and, hence, the supply of assets in the domestic financial market—is shored up by an exogenous force, making capital outflows less likely.[10]

Taxes and Subsidies.—We follow the large literature on idiosyncratic distortions in order to generate an initial condition with rampant resource misallocation (Restuccia and Rogerson 2008; Hsieh and Klenow 2009). The government may set individual-specific subsidies, financed by uniform revenue taxes. Individual-specific subsidy rates are denoted by $\varsigma_i \geq 0$, where the subscript indexes individuals in the economy. The uniform tax rate is denoted by $\tau \geq 0$. For entrepreneur i, his revenue after taxes and subsidies is $(1 - \tau)(1 + \varsigma_i) z_i k^\alpha l^\theta$. The corporate sector is also subject to the same tax rate, but is never subsidized.

The tax τ applies equally to everyone in the economy, and is assumed to be constant over time in the pre-reform periods. In our calibration (Section IIIB), we make ς_i co-vary with z_i in a particular way. Also, ς_i changes if and only if z_i does.[11] However, the set of individuals whose ς_i is non-zero does not change over time in the initial pre-reform economy.

We assume that the government balances its budget each period.

Credit (*Capital Rental*) *Markets*.—Individuals have access to competitive financial intermediaries, who receive deposits and rent out capital at rate R_t to entrepreneurs. We restrict the analysis to the case where credit transactions are within a period—that is, individuals' financial wealth is restricted to be non-negative ($a \geq 0$). The zero-profit condition of the intermediaries implies $R_t = r_t + \delta$, where r_t is the deposit rate and δ is the depreciation rate.

Capital rental by entrepreneurs is limited by imperfect enforceability of contracts. In particular, after production has taken place, entrepreneurs may renege on the contracts. A defaulting entrepreneur keeps a fraction $1 - \phi$ of the undepreciated capital and the after-tax revenue net of labor payments: $(1 - \phi)[(1 - \tau)(1 + \varsigma_i) z f(k, l) - wl + (1 - \delta) k]$, $0 \leq \phi \leq 1$. The punishment is the loss of their financial assets (a) held by the financial intermediary. In the following periods, such an entrepreneur is not treated any differently despite his history of default.

The one-dimensional parameter ϕ captures the extent of frictions in the financial market arising from imperfect enforcement of contracts. This parsimonious

[10] The latter point is the exact opposite of the role that the decline of the fully externally financed, state-owned enterprises plays in Song, Storesletten, and Zilibotti (2011), which reduces the supply of assets in the domestic financial market and makes capital outflows more likely.

[11] The dependence of ς_i and z_i is captured by a function $\varsigma = m(z, \varsigma_{-1})$, mapping the current productivity and last period's subsidy into the current subsidy rate. Conditional on $\varsigma_{-1} \neq 0$, this function is strictly decreasing in its first argument, and its value is equal to zero if $\varsigma_{-1} = 0$.

specification allows for a flexible modeling of limited commitment that spans economies with no credit ($\phi = 0$) and those with perfect credit markets ($\phi = 1$).

We consider the equilibria where the capital rental contracts are incentive-compatible. We study the equilibria where the rental of capital is quantity-restricted by an upper bound $\bar{k}(a, z, \varsigma; \phi)$, which is a function of the individual wealth, entrepreneurial productivity, and subsidy rate. We choose the rental limits $\bar{k}$ to be the largest limits that are consistent with entrepreneurs choosing to abide by their credit contracts. Without loss of generality, we assume $\bar{k}(a, z, \varsigma; \phi) \leq k^u(z, \varsigma)$, where k^u is the profit-maximizing capital input in the unconstrained static problem.

The following proposition, proved in Buera, Kaboski, and Shin (2011), provides a simple characterization of the set of enforceable contracts and the rental limit $\bar{k}(a, z, \varsigma; \phi)$.

PROPOSITION 1: *Capital rental k by an entrepreneur with wealth a, productivity z, and individual-specific subsidy rate ς is enforceable if and only if*

$$\max_{l} \left\{(1 - \tau)(1 + \varsigma) z f(k, l) - wl\right\} - Rk + (1 + r)\, a \geq (1 - \phi)\left[\max_{l} \left\{(1 - \tau)(1 + \varsigma) z f(k, l) - wl\right\} + (1 - \delta)\, k\right]. \tag{4}$$

The upper bound on capital rental that is consistent with entrepreneurs choosing to abide by their contracts is represented by a function $\bar{k}(a, z, \varsigma; \phi)$, which increases with a, z, ς, and ϕ.

Condition (4) states that an entrepreneur must end up with more economic resources when he fulfills his credit obligations (left-hand side) than when he defaults (right-hand side). This static condition is sufficient to characterize enforceable allocations because we assume that defaulting entrepreneurs regain full access to credit markets in the next period.

This proposition also provides a convenient way to operationalize the enforceability constraint into a simple rental limit $\bar{k}(a, z, \varsigma; \phi)$. Rental limits increase with the wealth of entrepreneurs because the punishment for defaulting (loss of collateral) is larger. Similarly, rental limits increase with the entrepreneurial productivity and idiosyncratic subsidy rate because defaulting entrepreneurs keep only a fraction $1 - \phi$ of the subsidy-adjusted revenue.[12]

Individuals' Problem.—The problem of an individual in period *t* can be written as

$$\max_{\{c_s, a_{s+1}\}_{s=t}^{\infty}} E_t \sum_{s=t}^{\infty} \beta^{s-t} u(c_s) \tag{5}$$

[12] We obtain an equivalent result with an alternative specification where entrepreneurs own capital and issue debt subject to a debt limit determined by a similar limited-commitment constraint, if we assume that productivity shocks are known one period in advance. The details of this analysis is available upon request.

subject to

$$c_s + a_{s+1} \leq \max\{w_s, \pi(a_s, z_s, \varsigma_s)\} + (1 + r_s) a_s, \quad \forall s \geq t,$$

where z_t, a_t, and the wage and interest rate sequences $\{w_s, r_s\}_{s=t}^{\infty}$ are given, and $\pi(a, z, \varsigma)$ is the maximized profit from operating the individual-specific technology. This indirect profit function is defined as follows:

$$\pi(a, z, \varsigma) = \max_{l,k} \left\{(1 - \tau)(1 + \varsigma) z f(k, l) - wl - (\delta + r) k\right\}$$

subject to

$$k \leq \bar{k}(a, z, \varsigma; \phi).$$

We denote the entrepreneurs' optimal input demand functions by $l(a, z, \varsigma)$ and $k(a, z, \varsigma)$. The max operator in the budget constraint (5) represents the occupational choice.

Competitive Equilibrium (*Closed Economy*).—We define equilibria for both an economy that is closed to capital flows and a small open economy facing a constant world interest rate. However, in our exercises we only consider small open economies.

We denote by $\mu_t(z, \varsigma)$ the cumulative density function of the joint distribution of entrepreneurial productivity z and individual-specific subsidy rate ς at time t. We denote by $G_t(a, z, \varsigma)$ the cumulative density function for the joint distribution of wealth, z, and ς, at the beginning of period t. For notational convenience, $G_t(a \mid z, \varsigma)$ is the associated c.d.f. of wealth conditional on a given (z, ς) pair.

A competitive equilibrium in a closed economy consists of sequences of joint distribution $\left\{G_t(a, z, \varsigma)\right\}_{t=0}^{\infty}$, allocations $\{c_t(a, z, \varsigma), a_{t+1}(a, z, \varsigma), l_t(a, z, \varsigma), k_t(a, z, \varsigma),$ $L_{c,t}, K_{c,t}\}_{t=0}^{\infty}$ for all $t \geq 0$, and prices $\{w_t, r_t\}_{t=0}^{\infty}$ such that:

- given $\{w_t, r_t\}_{t=0}^{\infty}$, $\left\{c_t(a, z, \varsigma), a_{t+1}(a, z, \varsigma), l_t(a, z, \varsigma), k_t(a, z, \varsigma)\right\}_{t=0}^{\infty}$ solve the individual's problem in (5) for all $t \geq 0$;
- the labor, capital, and goods markets clear for all $t \geq 0$:

  (Labor Market)

$$\int \left[\int_{\underline{a}_t(z,\varsigma)}^{\infty} l_t(a, z, \varsigma) G_t(da \mid z, \varsigma) - G_t(\underline{a}_t(z, \varsigma) \mid z, \varsigma)\right] \mu_t(dz, d\varsigma) + L_{c,t} = 0,$$

  (Capital Market)

$$\int \left[\int_{\underline{a}_t(z,\varsigma)}^{\infty} k_t(a, z, \varsigma) G_t(da \mid z, \varsigma) - \int_0^{\infty} a G_t(da_t(z, \varsigma) \mid z, \varsigma)\right] \mu_t(dz, d\varsigma) + K_{c,t} = 0;$$

- the government balances its budget each period:

$$\int (\tau + \tau\varsigma - \varsigma) z \left[\int_{\underline{a}_t(z,\varsigma)}^{\infty} k_t^{a}(a, z, \varsigma) l_t^{\theta}(a, z, \varsigma) G_t(da \mid z, \varsigma)\right] \mu_t(dz, d\varsigma) + \tau Z_c K_{c,t}^{a} L_{c,t}^{1-a} = 0;$$

- the joint distribution of wealth, productivity and individual-specific subsidy $\left\{G_t(a, z, \varsigma)\right\}_{t=1}^{\infty}$ evolves according to the equilibrium mapping:

$$G_{t+1}(a, z, \varsigma) = \psi \int_{\{a_{t+1}(\hat{a}, \hat{z}, \hat{\varsigma}) \leq a, \hat{z} \leq z, \hat{\varsigma} < \varsigma\}} G_t(d\hat{a}, d\hat{z}, d\hat{\varsigma})$$

$$+ (1 - \psi) \int_{\{a_{t+1}(\hat{a}, \hat{z}, \hat{\varsigma}) \leq a, \tilde{z} \leq z, m(\tilde{z}, \hat{\varsigma}) \leq \varsigma\}} G_t(d\hat{a}, d\hat{z}, d\hat{\varsigma})\, \Omega(d\tilde{z}),$$

where the function $m(z, \varsigma_{-1})$ is defined in footnote 11 and Ω is the invariant c.d.f. of the z distribution.

Competitive Equilibrium (*Small Open Economy*).—A competitive equilibrium for a small open economy is defined similarly, given a world interest rate r^*. In this case, the domestic capital rental market and goods market do not need to clear, and the net foreign asset (*NFA*) position is

$$NFA_t = \int \left[\int_0^{\infty} a\, G_t(da \mid z, \varsigma) - \int_{\underline{a}_t(z, \varsigma)}^{\infty} k_t(a, z, \varsigma)\, G_t(da \mid z, \varsigma)\right] \mu_t(dz, d\varsigma) - K_{c,t}.$$

In addition, for a small open economy, we impose irreversibility on *aggregate* capital used for domestic production:

$$(6) \quad \int \left[\int_{\underline{a}_t(z, \varsigma)}^{\infty} k_t(a, z, \varsigma)\, G_t(da \mid z, \varsigma)\right] \mu_t(dz, d\varsigma) + K_{c,t}$$

$$\geq (1 - \delta)\left\{\int \left[\int_{\underline{a}_{t-1}(z, \varsigma)}^{\infty} k_{t-1}(a, z, \varsigma)\, G_{t-1}(da \mid z, \varsigma)\right] \mu_{t-1}(dz, d\varsigma) + K_{c,t-1}\right\}.$$

That is, while there is no irreversibility at the individual level, it is assumed that capital used for domestic production cannot be shipped abroad. Note that this assumption puts a *lower* bound on investment rates, and hence limits capital *outflows*. We will subsequently show that, in our main exercises, capital flows out *in spite of* this irreversibility constraint on aggregate capital.

Obviously, this constraint does not bind in steady states. It may bind along our transitions, in which case, the domestic capital rental rate $r_t + \delta$ falls below the world capital rental rate $r^* + \delta$ so that (6) holds with equality. This also requires that the price of capital installed domestically appreciate over time to make individuals indifferent between holding capital domestically and abroad.[13]

Discussion.—The model we propose here to explain the joint dynamics of TFP, investment, and saving during growth accelerations has a rich structure that can capture and highlight the disparate forces driving these variables. In the accompanying

[13] For the transition in which the irreversibility constraint binds at least once, there needs to be an instantaneous drop in the price of domestic capital in response to the implementation of the reform that triggers the transition. The domestic capital price then increases over time, as long as the irreversibility constraint binds, and eventually becomes one, precisely when the irreversibility constraint ceases to bind.

online Appendix, we present a simpler version of our model that features two types of entrepreneurs with permanently fixed productivity, constant returns function in capital and labor, full depreciation of capital, and log utility. It can produce similar TFP and investment dynamics, but not saving rates.

We find that two elements are essential for replicating the observed behavior of saving in the early stages of growth accelerations. First, entrepreneurs earn a positive share of income in addition to the return on their wealth—i.e., $\alpha + \theta < 1$. Second, the entrepreneurial productivity is stochastic (and mean-reverting). These assumptions imply that, even after accumulating the collateral (i.e., financial wealth) needed to operate at the unconstrained profit-maximizing scale, productive entrepreneurs save to smooth their consumption in the face of stochastic entrepreneurial income. These elements do not exist in the simple version of our model with linear policy rules. In Section IVA, we discuss the respective role of disparate saving motives in detail. In Section IVD, we further show that, without the permanent income and precautionary saving motives, saving rates decline monotonically after an initial upward jump at the time of a reform, even when the reform is gradually implemented.

III. Calibration

We first calibrate preference and technology parameters, including the stochastic process of entrepreneurial productivity, by assuming that the distortion-free, perfect-credit, closed-economy version of our model approximates the United States, a large, relatively undistorted economy (Section IIIA). We further assume that the United States determines the world interest rate. The developing country to be analyzed differs from the United States in three ways (Section IIIB). First, it is a small open economy that takes the world interest rate as given. Second, prior to the reforms, there are rampant idiosyncratic distortions in the form of individual-specific subsidies financed by uniform revenue taxes. Third, there are domestic financial frictions.

A. *Preference and Technology Parameters*

The utility function, the entrepreneurial span-of-control production function, and the stand-in production function of the corporate sector are in equations (1), (2), and (3).[14]

The entrepreneurial productivity z is assumed to follow a Pareto distribution, with the cumulative density given by $\Omega(z) = 1 - z^{-\eta}$ for $z \geq 1$. Each period, an individual may retain his previous entrepreneurial productivity with probability ψ. Obviously, ψ controls the persistence of the individual z process, while η determines the dispersion of productivity in the population.

[14] This part follows the calibration strategy of Buera, Kaboski, and Shin (2011). Because Buera and Shin (2013) has a similar model and adopts the same calibration strategy for these parameters, it has calibration results that are similar to what is reported in this section.

We now need to determine nine parameter values: two corporate technology parameters, Z_c and α_c; the depreciation rate δ; two entrepreneurial technology parameters, α and θ; two parameters describing the entrepreneurial productivity process, ψ and η; the coefficient of relative risk aversion, σ, and the subjective discount factor, β.

We set σ to 1.5 following the standard practice. The one-year depreciation rate is $\delta = 0.06$. We choose $\alpha_c = \alpha/(\alpha + \theta) = 0.33$ to match the aggregate income share of capital. For the TFP of the corporate sector, Z_c, we first derive the aggregate production function of the entrepreneurial sector with perfect credit markets $(\phi = 1)$. We then equate Z_c to the TFP term of the aggregate entrepreneurial production function, which is a function of the right tail of the entrepreneurial productivity distribution $\Omega(z)$. This Z_c falls in the ninety-fifth percentile of the z distribution.[15] Once we assume perfect credit markets, there is no meaningful distinction between the corporate sector (full access to external financing by assumption) and the entrepreneurial sector (normally subject to financial frictions) on the production side. For the calibration of the perfect-credit economy, we assume that all production is done by the entrepreneurial sector, with full access to external financing.[16]

We are now left with four parameters—$\alpha + \theta$, η, ψ, β—and, hence, target as many relevant moments in the US data: the employment share of the top decile of establishments by size; the share of earnings generated by the top five percentiles of the population; the exit rate of establishments; and the real interest rate. To be more specific, we calibrate the perfect-credit, closed economy benchmark of our model without idiosyncratic distortions to match these moments in the United States.[17]

The first column of Table 2 shows the four moments in the US data. The decile with the largest—measured by employment—establishments in the United States accounts for 69 percent of the total employment in 2000. The earnings share of the top five percentiles of the population is 0.3 in 1998, and the annual establishment exit rate is 0.1 in the US Census Business Dynamics Statistics. Finally, as the target interest rate, we pick four percent per year.

The second column of Table 2 shows the moments simulated from the calibrated model. Even though in the model economy all four moments are jointly determined, each moment is primarily affected by one particular parameter. Given the span of control $\alpha + \theta$, the tail parameter of the z distribution η can be inferred from the establishment size (employment) distribution. Then, $\alpha + \theta$ can be inferred from the earnings share of the top five percentiles of the population because top earners are

[15] One interpretation of this assumption is that a representative fraction of population works in the corporate sector (including workers and entrepreneurs/managers), producing with the same individual technology, having access to perfect credit markets, and perfectly diversifying entrepreneurial risk.

[16] The entrepreneurial and corporate sectors are equivalent in terms of productive efficiency with perfect credit markets, given our construction of Z_c. As modeled here, production in the corporate sector avoids all the risks faced by individual entrepreneurs. This assumption clearly understates the magnitude of idiosyncratic risks because real-world managers in the corporate sector do bear substantial risks. However, our assumption that all production is done by the entrepreneurial sector maximizes the amount of idiosyncratic risk in the economy. Relaxing it only affects the calibration of the discount factor, leading to a higher β.

[17] The assumption that the United States has perfect credit markets is not unreasonable. The ratio of external finance to GDP in the calibrated perfect-credit economy $(\phi = 1)$ is 2.3, which is close to the value in the US data of 1.9 as measured by the average ratio of private credit by deposit money banks and other financial institutions to GDP in the 2000s. Nevertheless, as a robustness check, we have recalibrated parameters assuming that the United States also has financial frictions. As we explain in Appendix C.1, this recalibration has virtually no effect on the post-reform transition dynamics of the developing countries.

Table 2—Calibration

	US data	Model	Parameter
Top 10 percent employment	0.69	0.69	$\eta = 4.84$
Top 5 percent earnings share	0.30	0.30	$\alpha + \theta = 0.79$
Establishment exit rate	0.10	0.10	$\psi = 0.89$
Real interest rate	0.04	0.04	$\beta = 0.92$

Note: The model quantities are from the perfect-credit benchmark ($\phi = 1$) without idiosyncratic distortions.

Source: Authors' calculations

mostly entrepreneurs in the data and the model, and $\alpha + \theta$ controls the entrepreneurial share of income. We obtain $\alpha + \theta = 0.79$ and $\eta = 4.84$. The parameter $\psi = 0.89$ leads to an annual exit rate of 0.1. Finally, with a discount factor of $\beta = 0.92$, the model hits the annual interest rate of four percent.

B. *Idiosyncratic Distortions and Financial Frictions*

We now discuss the calibration of the parameters governing the taxes and idiosyncratic subsidies, as well as the one for financial frictions, which adapts and improves upon the relevant procedures in Buera and Shin (2013). In our transition exercises, the initial state of the economy is a stationary equilibrium where individuals are subject to taxes and idiosyncratic subsidies. While the economy is open to international capital flows, the domestic financial markets are underdeveloped and entrepreneurs are subject to collateral constraints.

The idiosyncratic subsidies in the initial equilibrium are modeled as a legacy of past industrial policies, following Buera, Moll, and Shin (2013). To be more specific, we assume that, a sufficiently long time ago, the government introduced individual-specific subsidies $\varsigma_{i,t}$ for $i \in [0, \lambda]$, where $\lambda \leq 1$ is the fraction of the population selected. The set of individuals who are subsidized does not change over time. The distribution of z among the fraction λ of selected individuals is identical to the distribution of z in the population as a whole on the eve of the reform. This is a natural outcome of the policy inertia and the stationarity of the z-process.[18]

For the fraction λ of individuals, $\varsigma_{i,t}$ is assumed to satisfy for all i and t:

$$(1 + \varsigma_{i,t})\, z_{i,t} = \bar{z},$$

for some constant $\bar{z}$. That is, the subsidy is negatively correlated with individuals' entrepreneurial productivity and can be even negative for those few with a $z_{i,t}$ exceeding $\bar{z}$. Note that $\varsigma_{i,t}$ will change if and only if $z_{i,t}$ changes. To pay for the subsidy, the government levies a uniform revenue tax τ. We point out that the subsidy rates and the entrepreneurial productivity are negatively correlated not only among the fraction λ of subsidized entrepreneurs (which holds by construction) but also among all active

[18] An alternative interpretation of the distortions is that they are sector-specific subsidies. An important complementary assumption in this case is that an individual's productivity is sector specific, and the subsidized sectors are not the most productive ones on the eve of the reform.

entrepreneurs. Of all the low-productivity individuals, only those who are subsidized will be active producers. This negative correlation between measured idiosyncratic subsidies and plant-level TFP is confirmed in the available data (Section IVC).

Given our modeling of idiosyncratic subsidies, we have three parameters to pin down: the fraction subsidized, λ, the parameter controlling the subsidy recipients' profitability, $\bar{z}$, and the tax rate, τ. We will simply assume that $\bar{z}$ is equal to Z_c, the TFP term of the corporate sector technology. The tax rate τ will be chosen to satisfy the government budget constraint. This leaves us with λ.

In our main exercise, the macroeconomic transitions are triggered by an unexpected reform that eliminates all taxes and idiosyncratic subsidies at once. We calibrate λ to the increase in the aggregate TFP of the model economy along the post-reform transition.[19] We use the data from the 22 sustained growth acceleration episodes since 1980 (Section I), which show that aggregate TFP increases by 30 percent through 20 years of sustained growth accelerations on average.[20] The calibrated values of the distortion-related parameters are $\lambda = 0.0098$ and $\tau = 0.18$, given $\bar{z} = Z_c$.[21]

In our benchmark exercise, the parameter for the domestic financial market imperfections, ϕ, is not affected by the reform and held constant. This parameter can be identified primarily by the ratio of external finance to GDP as measured by the ratio of private credit by deposit money banks and other financial institutions to GDP following Beck, Demirgüç-Kunt, and Levine (2000).[22] For the 22 post-1980 sustained growth accelerations, we compute each economy's average external finance to GDP ratio over years 15–20 of the sustained acceleration episode, which is in turn averaged across the acceleration episodes. This average is 0.53, and we obtain this number (also over years 15–20 after the reform) in the model by setting $\phi = 0.12$.[23]

C. *Exogenous Dynamics: Corporate Sector*

Because the corporate sector in the model is a constant-returns technology, the relative size of the corporate sector in the economy is indeterminate. For this reason,

[19] Not all the TFP increase in our benchmark transition comes from the elimination of idiosyncratic subsidies. As shown in Section IIIC, we feed into the model an exogenous rise of the corporate sector, which partly accounts for the rise in the aggregate TFP along the transition.

[20] The aggregate TFP, both for the data and the model, is computed as $Y/(K^{1/3}L^{2/3})$, where Y is gross domestic product, K is aggregate capital, and L is the number of workers. For the model TFP calculation, L includes both workers and entrepreneurs, which is consistent with the data counterpart.

[21] The assumption that $\bar{z} = Z_c$ results in an average subsidy rate of 92 percent when computed over the 0.98 percent of the population who are subsidized. This average may seem too high, so we have worked out an alternative calibration where we exclude the bottom 75 percentiles of the z distribution from subsidy altogether. This implies an average subsidy rate of 50 percent. To match the same target moment (i.e., the post-reform TFP growth), we now have to subsidize fraction $\lambda \approx 0.04$ of each z type in the top 25 percentiles. The fraction of subsidy recipients in the population is still around 0.01 ($= 0.04 \times 0.25$). We find that the resulting transition dynamics are nearly indistinguishable from the benchmark results in Section IVA. It seems that what matters for our result on capital flows is who gets subsidized rather than what the average subsidy rate is. If those with marginal levels of z (say, between 80 and 90 percentiles) are moderately subsidized, their reaction to the loss of subsidy will still shape the aggregate investment and saving dynamics immediately after the reform. We discuss this in Section IV.

[22] As described by Beck et al., this measure isolates "credit issued to the private sector and concentrates on credit issued by intermediaries other than the central bank." We use the 2012 update of their data.

[23] External finance in the model includes not only the entrepreneurial capital input in excess of their net worth but also all the capital input of the corporate sector. The former is governed by ϕ and the latter by the relative size of the corporate sector described next.

we feed into the model an exogenous time path of the capital used by the corporate sector. The construction of this time path is based on the assumption that publicly traded firms are the real-world counterpart of the financially unconstrained corporate sector in the model. For each of the 22 sustained growth episodes since 1980, we compute the time series of total stock market capitalization and multiply it by the average book-to-market ratio (about 0.5) over the same period. We then divide this estimate of corporate sector capital stock series by the aggregate capital stock series, and take the period-by-period average of the resulting ratios across the 22 episodes. In this calculation, the fraction of capital used by the corporate sector is close to zero in the pre-reform periods, but goes up to 0.25 in years 15 through 20 of the sustained growth accelerations. This time path is then exogenously imposed on the model transition, which we assume also pins down the labor input in the corporate sector via the unconstrained factor ratio: $L_{c,t} = K_{c,t}(1 - \alpha_c) R_t/(\alpha_c w_t)$.

An increasing relative importance of the corporate sector has two direct consequences on the macroeconomic transition. First, because the TFP of the corporate sector Z_c is assumed to be the same as the TFP term of the aggregate production function in the perfect-credit economy, the corporate sector is more productive than the average entrepreneurs in economies with financial frictions. A rise of the corporate sector mechanically raises the measured TFP of the economy as a whole through the simple compositional effect. We report in Section IVA that about half of the post-reform TFP increase comes through this channel. Second, because by assumption all capital in the corporate sector is externally financed, a rise of the corporate sector lifts with it the amount of external finance and hence the supply of assets in the domestic financial market.

As we discussed in Section II, the corporate sector is by no means necessary for our result. To the contrary, the exogenous growth of a more productive, fully externally financed corporate sector diminishes the quantitative importance of distortion-removing reforms, and, by driving up the supply of domestic assets, makes capital less likely to flow out.[24]

IV. Post-reform Transition Dynamics

In this section, we study three reform exercises that start from the same initial condition constructed in Section IIIB: the stationary equilibrium of a small open economy that has idiosyncratic distortions and imperfect domestic financial markets.[25] We first consider a sudden elimination of idiosyncratic subsidies and taxes (Section IVA), and then a broader reform that also improves the domestic financial markets (Section IVB). We also implement a gradual removal of idiosyncratic

[24] In an early version of this paper, we omitted the corporate sector altogether, but obtained very similar results, except for the TFP growth in the latter phase (more than 10 years after the reform). As we explain in Section IVA, the front-loaded reform is the primary driving force of the early phase of the TFP growth, and the gradual rise of the corporate sector is more important for the latter phase.

[25] Buera and Shin (2013) was the first paper to analyze the transition dynamics following the removal of idiosyncratic distortions, albeit in a closed economy, where saving must equal investment. Our analysis emphasizes the economic forces that separately drive saving and investment, which had no room to operate in a closed economy.

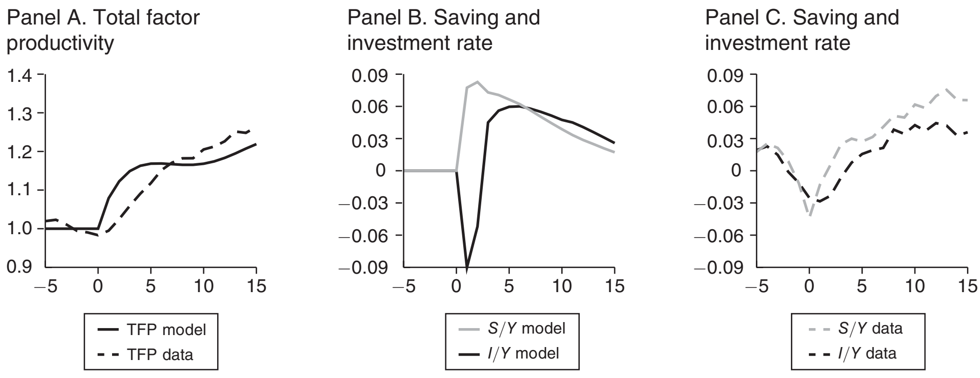

Figure 2. Transition Dynamics: Sudden Elimination of Idiosyncratic Distortions

subsidies and taxes, and compare the evolution of measured idiosyncratic distortions in the model with the available micro-level evidence (Section IVC).

Finally, Section IVD works out the sudden and gradual reform exercises without the entrepreneurial productivity shock, so that we can better assess the relative contribution of the diverse forces behind aggregate saving dynamics.

A. *Elimination of Taxes and Idiosyncratic Subsidies*

The economic reform occurs at $t = 0$. It is completely unexpected, but once it happens, everyone understands that it is a permanent change. In this exercise, the reform consists of only one component: the sudden elimination of all taxes and idiosyncratic subsidies (τ and ς_i). The economy is already open to capital flows before the reform, and remains so afterward. We assume that domestic financial frictions, controlled by ϕ, remain as before. We are thinking of financial frictions as arising from legal enforcement problems, which are a component of broader institutions and are hence slower moving. This idea is consistent with the sluggish improvement of financial markets even during sustained growth accelerations, as measured by the ratio of external finance to GDP over time.

We acknowledge that this is a very stark exercise, oversimplifying real world reform processes. The advantage is that the dynamics following the reform are wholly endogenous. We emphasize that our calibration of the distortion-related parameters only uses information on the starting point (years immediately preceding the start of sustained growth accelerations) and the end point (years 15 through 20 of such accelerations), not the path between the two. The only exception is the exogenous time series we impose on the model to pin down the relative magnitude of the corporate sector, as discussed in Section IIIC.

Aggregate Dynamics.—The result of this reform exercise is shown in Figure 2. The solid lines represent the model simulations, and the dashed lines reproduce the average across the 22 post-1980 sustained growth accelerations in Figure 1. From year 0 on, with the idiosyncratic subsidies and taxes gone, resources are reallocated more efficiently. Reallocation occurs along two margins. First, capital and labor are reallocated among existing entrepreneurs (intensive margin). Those who lose subsidy downsize, and those who are now free from taxes (τ) ramp up their production. Second, more individuals with high productivity will enter into business now that taxes are gone, while previously-subsidized low-productivity entrepreneurs will exit (extensive margin). The reallocation along these two margins occurs gradually—the horizontal axis is in years—slowed down by the frictions in the financial market: It takes time for a productive-but-poor entrepreneur to save up and self-finance the capital needed for operating at a profit-maximizing scale. The increase in TFP reflects this reallocation (left panel). Over the first four years, TFP increases by about four percent per year. In the figure, the model TFP resumes its ascent from year 10 on. This phase is driven by the exogenous rise of the corporate sector. In this exercise, it turns out that the removal of idiosyncratic distortions and the rise of the corporate sector contribute almost equally (51 and 49 percent respectively) to the rise in the aggregate TFP over 20 years following the reform. However, the front-loaded reform is the primary driving force of the early phase of the TFP growth (years 0 to 5), while the gradual rise of the corporate sector is more important for the latter phase (years 10 to 20).[26]

GDP per capita (not shown) increases after the reform, largely mirroring the increase in TFP. The TFP and GDP in the model increase much faster than in the data initially, but slow down significantly after year five. This is because we model the reform as a sudden and drastic one-off event. Its real-world counterparts are more gradual. Section IVC models the reform as a more gradual process.

The center panel of Figure 2 shows the net investment (black solid line) and saving (gray solid line) rates in our model. With the reform, investment rates drop, and then rise above the pre-reform level, only to fall gradually as the economy converges to the new steady state. Saving rates rise first and then slowly revert to the new steady state level. As a result, capital flows out of the country while the TFP increases fast during the first five years after the reform.

Investment Rate Dynamics.—With the reform, the entrepreneurs losing their subsidy will downsize and begin to exit, substantially reducing the demand in the domestic capital rental market. However, their disinvestment is not immediately offset by productive individuals who were previously taxed: They are not rich enough to overcome collateral constraints and scale up their production right away. They have to save up enough collateral first. This explains the initial drop in investment. In fact, during the first two years of the post-reform transition, the irreversibility on the aggregate domestic capital, constraint (6), binds.[27] Investment would have fallen even further—and more capital would have flown out—without the aggregate

[26] The model TFP and the empirical counterpart coincides in year 20, which is a target moment in our calibration of the initial distribution (Section IIIB).

[27] This implies that the domestic capital rental rate is lower than $r^* + \delta$ during this period. Reflecting this, immediately after the reform, the price of domestically installed capital goes down by 6 percent. Subsequently, the price rises, until it reaches parity with the price of capital held abroad in year three. Individuals are indifferent between holding capital domestically and abroad, as the low rental rate of domestically installed capital is compensated by its appreciation. The drop in the price of capital at the moment of the reform is assumed to reduce the net worth of all individuals proportionately.

capital irreversibility.[28] Over time, productive individuals enter into entrepreneurship and increase their scales of operation, boosting domestic demand for capital and hence investment.

As with the TFP dynamics, the gradually rising corporate sector pushes up the aggregate investment, partly explaining why investment rates are higher than saving rates in the latter phase of the transition (years 10 to 20, center panel of Figure 2).

Saving Rate Dynamics.—As for saving, three disparate forces should be considered: permanent income saving behavior, constrained entrepreneurs' self-financing, and precautionary saving. First, while low-productivity individuals (i.e., workers) face an income profile that rises over time as wages rise after the reform, as for the most productive and wealthiest entrepreneurs, their income is particularly and temporarily high right after the reform, precisely because factor prices—both wages and domestic rental rates—are temporarily low before they rise to the new steady-state levels. Thus, productive and wealthy entrepreneurs save a higher fraction of profits in a manner consistent with the permanent income theory. Second, productive entrepreneurs choose high saving rates, so that they can overcome the collateral constraints over time and self-finance their profitable business. However, self-financing alone cannot explain why saving grows faster than investment because entrepreneurs do have access to external finance. In other words, they can invest more than they save, with the collateral constraints limiting the magnitude of this leverage. Self-financing, nevertheless, restricts the excess investment over saving for individual entrepreneurs. Third, the elimination of idiosyncratic subsidies and taxes in our calibration leads to a higher dispersion of entrepreneurial income. More dispersion means more risk, and entrepreneurs engage in additional precautionary saving. These saving behaviors of entrepreneurs explain the high aggregate saving rates along the post-reform transition.

The patterns of aggregate saving and investment rates in the model are consistent with the data at least qualitatively. In the right panel of Figure 2, we reproduce the average saving (gray dashed line) and investment (black dashed line) rates across the 22 post-1980 sustained growth accelerations. In most sustained growth accelerations, saving rates go up from the beginning. Investment rates remain flat for the first few years, in spite of the sustained acceleration in TFP in the data (dashed line, left panel). Unsurprisingly the model transitions are faster because of the drastic nature of the reform in the model.

Investment and Saving Conditional on Entrepreneurial Productivity.—The aggregate dynamics of investment and saving rates are shaped by the capital and wealth accumulation decisions of heterogeneous individuals, who are affected differently by the reform. To further illustrate this point, in Figure 3, we show the evolution of the income-weighted average saving rates (gray lines) and investment rates (black lines)

[28] If we remove the aggregate irreversibility constraint and assume that domestic capital can be frictionlessly reallocated and used for production overseas within the same period, the net investment rate immediately following the reform is −39 percent, implying a massive capital outflow. Following this initial adjustment, investment rates jump up to nine percent and monotonically decline over time. Except for the initial capital outflow, the subsequent periods exhibit very small capital flows in either direction.

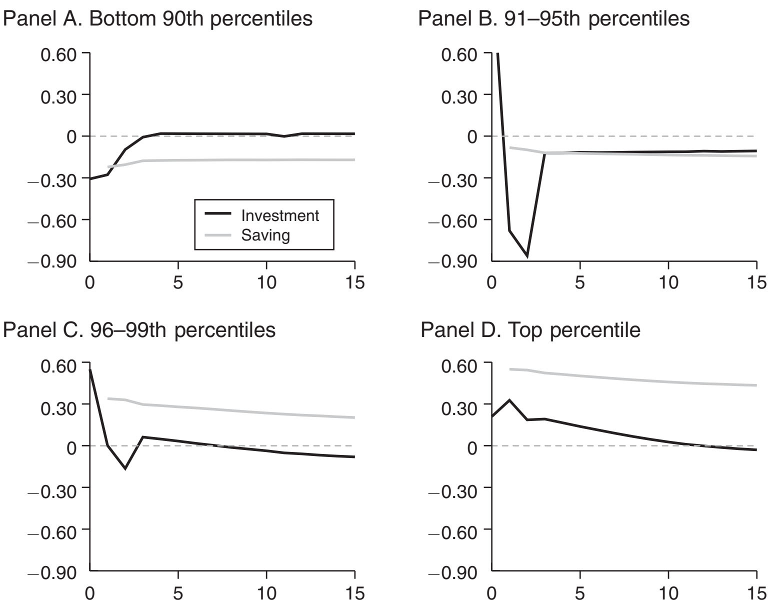

Figure 3. Saving and Investment Rates by Entrepreneurial Productivity Percentiles

for four entrepreneurial productivity groups: bottom ninetieth percentiles, ninety-first to ninety-fifth percentiles, ninety-sixth to ninety-ninth percentiles, and top one percentile. The groups are based on each period's z realization, and the identities of the individuals in each group change over time. In each group, the fraction of entrepreneurs losing subsidy is small, since in our calibration the fraction subsidized is only $\lambda = 0.0098$ and the z distribution of subsidy recipients are the same as the population z distribution. Nevertheless, the initial saving and investment dynamics of each group are heavily influenced by this small fraction of entrepreneurs, because they account for a disproportionately large income share early on, and the group-level saving and investment rates are an income-weighted average of individual-level saving and investment rates. This is especially true for the first two productivity groups (bottom ninetieth percentiles and ninety-first to ninety-fifth percentiles). In the initial state, the subsidy recipients in these two groups compose a large fraction of the active entrepreneurs in the respective group, and entrepreneurs' income is far larger than workers.'

Investment Rate by Entrepreneurial Productivity.—In the first group (bottom ninetieth percentiles), right after the reform, nearly all producers are those who had subsidies before. With the loss of subsidy and an incremental rise in the wage, they gradually reduce their production scale and eventually exit. Their exit is not immediate because the wage is low initially, relative to its level in the new steady state, and also their wealth offers them a comparative advantage as a producer (compared to being a worker).

In the second group (ninety-first to ninety-fifth percentiles), even many of those not subsidized are entrepreneurs prior to the reform and are relatively wealthy. Immediately after the reform, the profitability of previously unsubsidized entrepreneurs increases because taxes are gone and wages are relatively low. This leads to a one-period investment boom for the continuing entrepreneurs and the entry of marginal entrepreneurs, which more than offset the disinvestment of the previously subsidized, wealthy entrepreneurs in the group. With the rising wage, marginal entrepreneurs and previously subsidized entrepreneurs exit over the following two periods, resulting in a massive drop in the group investment rates.

The discussion for the third group (ninety-sixth to ninety-ninth percentiles) is different because, in the way we set up the individual-specific subsidies, the subsidy recipients actually face a small negative subsidy or a small additional tax on their output. For this group, the distinction between those previously subsidized and not subsidized is uninformative for the investment rate dynamics. The reform means a tax cut and also lower factor prices for everyone in the group. At the intensive margin, those who are wealthy enough scale up their production in response. At the extensive margin, those in this productivity group who were too poor to be entrepreneurs in the pre-reform economy enter into production. The end result is, as in the second group above, a one-period investment boom. As the factor prices increase in the following periods, the poorer members of the group start to exit, driving the investment rates below zero. Once they exit, the investment rates recover in year three.

The economic forces shaping the investment rate dynamics of the final group (top percentile) are the same as those of the third group. The difference is that even the poorest in this group are active entrepreneurs both before and after the reform, and all adjustment occurs at the intensive margin. The reform implies lower taxes and factor prices for everyone in this group. They respond by increasing their production and demand for capital, driving up the investment rates. The collateral constraint limits the increase in investment rates and also makes them persistent (i.e., adjustments spread over several periods). Because there is no extensive margin adjustment for investment, the top group's investment rates do not feature the extreme gyration driven by the entry and exit of poor entrepreneurs observed during the first few years in the third group.

Because the first two groups (ninety-fifth percentile and below) account for the majority of the aggregate income in the first few years of the post-reform transition, and because it takes time for even the most productive individuals to accumulate collateral and scale up, the disinvestment of those losing subsidy dictates aggregate investment rates early on. Only after the first three years, the income share of the most productive individuals becomes large enough that the aggregate investment rates more closely track their behavior.

Saving Rate by Entrepreneurial Productivity.—To explain the behavior of aggregate saving rates, it is useful to divide the population into two groups. Because of the average saving rate differences in Figure 3, we refer to those in the ninety-sixth percentile and above (bottom panels) as high savers and the rest (bottom ninety-fifth percentiles, top panels) as low savers. The high z individuals save a large portion of their income for two reasons. First, many of them are financially constrained entrepreneurs and, since financial assets serve as collateral and relax the constraints, their returns to saving can be much higher than the market interest rate. This self-financing motive is an important driver of entrepreneurial saving, especially those who are productive but poor. Second, because the entrepreneurial productivity process is mean-reverting, the productive entrepreneurs expect their earnings to be lower in the future. This motivates additional saving consistent with the permanent income theory. It is now clear why the lower z individuals have low (indeed negative) saving rates on average. Almost all of them are workers or marginal entrepreneurs, and hence they have no self-financing motive. In addition, because being a worker is the worst possible outcome in terms of earnings shocks in this model, their earnings are expected to be higher in the future, which means dis-saving is optimal.[29]

The high aggregate saving rates immediately following the reform are explained by (i) the shifting income share from the low-savers to the high-savers and (ii) the temporary spike in the high-savers' saving rates.

Before the reform, subsidy recipients have significantly higher income and wealth than those not subsidized. Because of our construction of the initial condition, exactly 95 percent of all subsidy recipients are in the bottom ninety-fifth percentiles of the z distribution. The implication is that the removal of subsidies will instantaneously reduce income share of the low savers, the group with 95 percent of those losing subsidy. This sudden shift of income share from low savers to high savers leads to an upward jump in the aggregate saving rate.

The saving rates of the high savers actually increase in the years immediately following the reform for three reasons. First, the elimination of taxes increases the optimal scale of production for active entrepreneurs, generating an extra motive for accumulation of collateral (i.e., self-financing). Second, factor prices are lower than their new steady-state levels because financial constraints prevent productive entrepreneurs from immediately absorbing all the capital and labor released by those losing subsidy. Temporary low factor prices imply temporary high profits for productive and wealthy entrepreneurs. They save a large fraction of their temporary high income, consistent with the permanent income theory.[30] Finally, the elimination of the proportional revenue taxes increases the overall variance of the individual income processes, especially for those with a high z. They respond with additional precautionary saving.

To sum up, through the interactions of individuals' heterogeneous saving and investment behaviors, our model explains why capital may flow out of countries with fast growing TFP. We next illustrate the role of domestic financial frictions in this process.

B. *Tax/Subsidy Elimination and Domestic Financial Reform*

The difference here is that the reform in year 0 has one additional component. Starting from the same initial condition, on top of the eliminaiton of idiosyncratic distortions, we also reform the domestic financial markets, increasing ϕ from 0.12 to

[29] If we introduce idiosyncratic shocks to the efficiency units of labor and hence individual wages, because of precautionary saving motives, workers' saving rates will go up.

[30] Above, we invoke the permanent income theory to explain why high z individuals are high savers in general. Our argument here is that the periods immediately following the reform are periods of higher than normal entrepreneurial income for any given z. The other side of this temporary low wages is that workers (low z individuals) see an increasing time path of wages. This explains the slightly increasing saving rate during the first few years of the bottom 90 percentiles (gray line, top left panel of Figure 3).

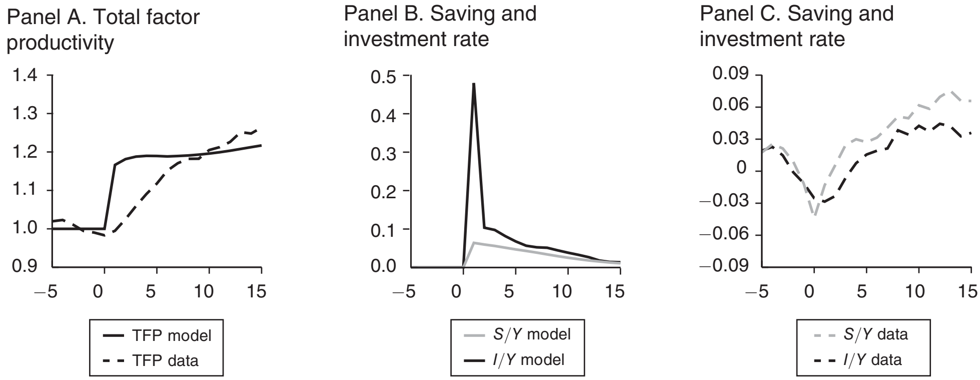

Figure 4. Transition Dynamics: Sudden Distortion Elimination and Financial Reform

0.5. The choice of $\phi = 0.5$ corresponds to an external finance to GDP ratio of 1.1 in the new steady state, a level that few developing countries attained before 2000. In this sense, $\phi = 0.5$ represents a very well-functioning financial market.

The results are in Figure 4. The reform leads to more efficient reallocation of resources, as is reflected on the TFP that rises faster and higher than in Section IVA.[31] The improved domestic financial market expedites the reallocation of capital among heterogeneous producers. In addition, it has its own permanent positive effect on the long-run level of TFP and hence GDP.[32]

However, it is the investment rate that is the most starkly different between the two exercises. Here, investment rates shoot up to a staggeringly high level, before crashing down to the levels that are comparable to those in Figure 2. In the early phase of the post-reform transition, investment rates far exceed saving rates, implying a massive *inflow* of capital into this fast-growing economy.

Entrepreneurs who lose their subsidy downsize and exit, just like in Section IVA. However, as the collateral constraints are now a lot less stringent thanks to the domestic financial market reform (higher ϕ), productive individuals can enter into entrepreneurship and start production immediately at a scale much larger than in Section IVA, even if they do not have much collateral. Their entry and expansion more than offset the disinvestment by incumbent entrepreneurs losing subsidy, and capital flows in from overseas to meet the excess capital demand immediately after the reform.

On the saving side, the effect is qualitatively similar to that in Section IVA. The difference is that the transition to the new steady state is much quicker with the domestic financial reform, which implies less of temporary high profits for productive and wealthy entrepreneurs. In turn, there is less room for the permanent income saving behavior to produce a temporary hike in saving rates. In addition, with the

[31] The dashed line in the left panel is the average normalized TFP from the same set of sustained growth episodes in Figure 2. The exercises in Sections IVA and IVB have the same initial condition, and Figures 2 and 4 have the same scale for TFP (left panels), facilitating visual comparison.

[32] Even in the stationary equilibrium, resources need to be reallocated from previously productive entrepreneurs to newly productive entrepreneurs. Financial frictions slow down this reallocation and have adverse effects on the long-run output and the measured TFP of the economy.

higher ϕ and more generous access to external financing, entrepreneurs now have a weaker self-financing motive. As a result, saving rates do not increase as much as in Section IVA.

In summary, investment jumps up initially, in contrast to Section IVA, while saving does not increase by as much, resulting in capital inflows during the post-reform transition.[33] In the Appendix, we follow up on this joint reform result and try various intermediate values of ϕ.We find that there is a threshold $\tilde{\phi} \approx 0.29$ such that capital flows out initially if the joint reform brings ϕ to a value lower than $\tilde{\phi}$, and flows in if the new ϕ is higher than $\tilde{\phi}$.

C. *Gradual Reform*

In Section IVA, we assume that the idiosyncratic subsidies and taxes of the initial economy are eliminated completely in one period. The resulting dynamics are too rapid and front-loaded, and it is unclear how closely the model can match the observed growth acceleration dynamics. In this section, we remove the idiosyncratic taxes and subsidies gradually over many periods, and ask how closely the model can replicate the observed joint dynamics of TFP and capital flows. We also compare the evolution of idiosyncratic distortions in the model with the available evidence from sustained acceleration episodes that followed reforms.

Aggregate Dynamics.—Starting from the same initial condition, we assume that the fraction subsidized λ now follows a geometrically decreasing sequence over time. That is, $\lambda_t = \lambda \varpi^t$ for $t = 0, 1, \ldots,$ where λ is the fraction subsidized in the initial stationary equilibrium and $\varpi \in (0,1)$ is the persistence parameter for the λ_t process. We maintain the assumption that the gradual demise of taxes and subsidies is announced at time 0 unexpectedly, but everyone knows its future path at that point. For subsidized entrepreneurs, this represents a probability $1 - \varpi$ of losing their subsidy each period. We also assume that the loss of subsidy is not correlated with the subsidized entrepreneurs' productivity. The government is assumed to run a balanced budget every period, which requires an endogenous time-series of revenue tax rate τ_t. As in the benchmark exercise of Section IVA, we assume that the domestic financial markets are not affected by the reform and ϕ remains intact.

Since the purpose of this exercise is to assess whether the model dynamics can mimic the empirical counterpart, we minmize over ϖ the distance between the model and the data in terms of TFP, saving rates, and investment rates over the first ten transition periods.[34] The ϖ that minimizes the distance is $\varpi = 0.88$.

[33] It is informative to compare this exercise with the standard neoclassical growth model. Our model with perfect local credit markets ($\phi = 1$) is isomorphic to the standard model. If the productivity of the aggregate production function is raised in the standard model, capital will flow into the small open economy and instantaneously equalize the marginal product of capital net of depreciation with the world interest rate.

[34] The empirical counterparts are from the 22 sustained accelerations, reproduced with dashed lines in Figure 5. With superscripts *D* and *M*, respectively, standing for the data and the model, the distance measure is as follows. (The distance is unweighted across variables and over time. We take log of the normalized TFP so that all three variables have a comparable scale.):

$$\sum_{t=1}^{10}\left[\left(\log TFP_t^D - \log TFP_t^M\right)^2 + \left(S_t^D/Y_t^D - S_t^M/Y_t^M\right)^2 + \left(I_t^D/Y_t^D - I_t^M/Y_t^M\right)^2\right].$$

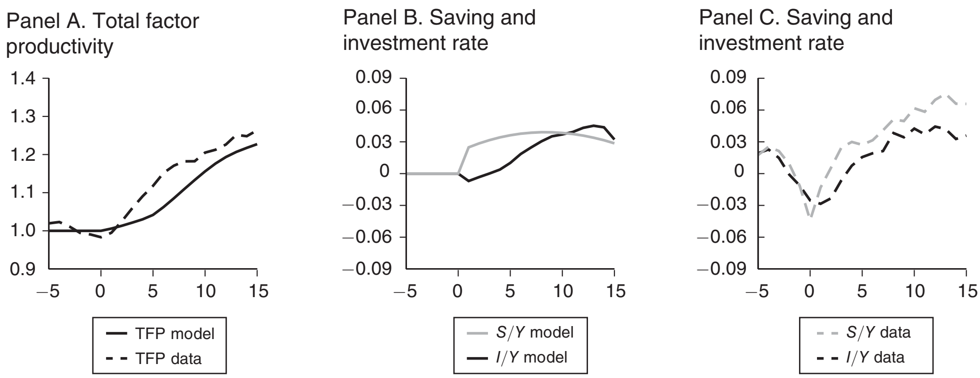

Figure 5. Transition Dynamics: Gradual Removal of Idiosyncratic Distortions

The model transition dynamics now look much closer to the data than the benchmark exercise (Figure 2). Integrating over the first 10 transition periods, the gradual reform exercise explains 60 percent of the TFP dynamics and 105 percent of the capital outflows.

It is obvious that the gradual reduction in taxes and subsidies implies a slower reallocation of resources than the sudden reform. As a result, both TFP and investment rates move much more smoothly than in the benchmark exercise.

However, saving rates are not as gradual over time. In Section IVA, the initial reaction of the aggregate saving rate to the reform is primarily explained by shifting income shares from low-savers to high-savers. By contrast, because the income shares change slowly with the gradual reform, the initial not-so-gradual change in saving rates is instead explained by the change in saving behavior of the subsidy recipients. Once the reform is implemented, subsidy recipients face a rapidly declining income process in expectation, because the loss of subsidy—with probability $1 - \varpi$ each period—significantly reduces income. Consistent with the permanent income theory, they raise their saving rates. Because of the gradual nature of the reform, subsidy recipients continue to account for a disproportionate share of the aggregate income for several periods after the reform, which means the aggregate saving rates remain high. In the benchmark exercise where the fraction subsidized goes from λ to 0 instantaneously, this saving channel does not exist.

In summary, the gradual reform exercise shows that, with another parameter (ϖ) controlling the model dynamics, its predictions come close to the time-series of TFP, saving rates, and investment rates in the data. While we can almost directly control the dynamics of TFP and investment rates with ϖ, the front-loaded rise in saving rates is less sensitive to it. The same driving forces behind the benchmark exercise (Section IVA) are still important, but we in addition emphasize the forward-looking saving behavior of those losing their subsidy.

Measures of Idiosyncratic Distortions: Model versus Available Data.—The key elements of our explanation for the TFP and capital flow dynamics are initial misallocation, a reform that removes distortions, and domestic financial frictions that slow down efficient reallocation. Although we use some direct evidence on financial frictions (i.e., the ratio of external finance to GDP), we only indirectly infer the degree of initial misallocation and the speed of the reform from the observed aggregate dynamics. Direct evidence on the idiosyncratic distortions that cause resource misallocation presupposes detailed firm- or establishment-level data over time, which are typically not available.

Here we report the evolution of idiosyncratic distortions for those sustained accelerations with available data. As in the methodology of Hsieh and Klenow (2009), the idiosyncratic distortions for an establishment are summarized by the geometric average of its average revenue products of capital and labor, weighted by the output elasticities. This quantity is called TFPR in the literature. A high TFPR corresponds to idiosyncratic taxes that deter the establishment from increasing production to take advantage of its high marginal revenue product. Conversely, a low TFPR implies idiosyncratic subsidies.

We summarize the distribution of TFPR in an economy using two statistics: (i) the standard deviation of the log of TFPR and (ii) the correlation between the log of TFPR and the log of the physical productivity of a plant (TFPQ). A large dispersion of TFPR indicates a wide range of idiosyncratic taxes and subsidies, and hence a high degree of resource misallocation. A positive correlation between TFPR and TFPQ implies that productive establishments are more likely taxed (i.e., producing too little) and unproductive ones are more likely subsidized (i.e., producing too much).

In Figure 6, we plot the time series of the standard deviation of log TFPR (left panel) and the correlation coefficient between log TFPR and log TFPQ (right panel) for our gradual reform simulation with black solid lines. Consistent with the way we introduce idiosyncratic subsidies into the pre-reform economy, the measured log TFPR has a large standard deviation and is strongly positively correlated with log TFPQ.[35] Both the standard deviation and the correlation decrease from year 0 on, as the subsidies and taxes are gradually removed.[36]

For comparison, we also show in Figure 6 the same statistics from the sustained accelerations of Chile, China, India, and Korea. For each country, we set the statistically identified beginning of the sustained acceleration as year 0: 1985 for Chile, 1991 for China, and 1983 for India and Korea.[37] In all four episodes, the measured idiosyncratic distortions (TFPR) have large standard deviations across manufacturing establishments and are highly correlated with establishments' physical productivity (TFPQ). More important, the standard deviations and the correlation coefficients decline over time. Although none of this information was used in our calibration, the dispersion of TFPR and its correlation with TFPQ are comparable to the data counterparts both in levels and in changes over time. The path of TFPR standard deviation of the model lies between those of Chile and Korea. It falls by as much as Chile's, but by more than the other three countries' (left panel). The

[35] As a reference point, according to the 2007 working paper version of Hsieh and Klenow (2009), the corresponding statistics for the United States, a relatively undistorted economy, are, respectively, 0.42 and 0.46.

[36] They do not converge to zero, even when all the idiosyncratic subsidies and taxes are gone, because the financial frictions still remain. Collateral constraints are more likely to bind for productive but poor entrepreneurs, leading to a dispersion in TFPR and also to a positive correlation between TFPR and TFPQ.

[37] The sources of the estimates are: Chen and Irarrazabal (2015) for Chile; the 2007 working paper version of Hsieh and Klenow (2009) for China and India; Kim, Oh, and Shin (2017) for Korea.

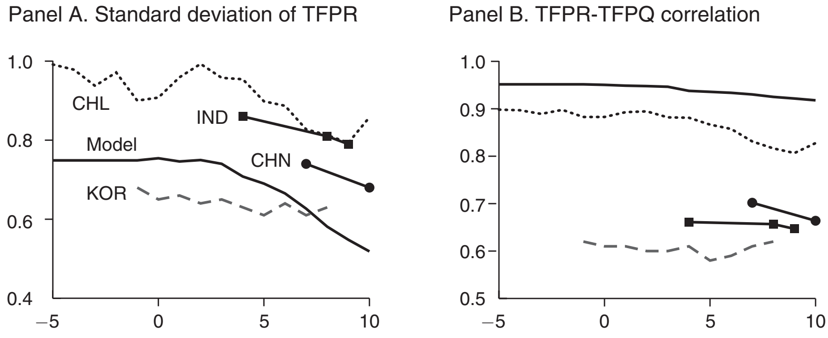

Figure 6. Evolution of Distortions: Model and Available Data

Notes: The standard deviation of log TFPR (panel A) and the correlation between log TFPR and log TFPQ (panel B) are computed from our gradual reform simulation (solid black lines) and the sustained growth accelerations with available micro-level data. The horizontal axis measures years, with year 0 marking the start of each sustained acceleration. For Chile (CHL) and Korea (KOR), we have yearly estimates in both the pre- and post-reform periods. For China (CHN) and India (IND), the few data points we have all come after the start of the reform.

TFPR-TFPQ correlation in the model is higher than those in the data, but its path is fairly close to that of Chile (right panel). We conclude that our modeling and calibration of the initial misallocation using idiosyncratic distortions are supported to a degree by the available micro-level measures of the idiosyncratic distortions during growth accelerations.[38]

Reforms and Idiosyncratic Distortions.—For the four countries above, we used a purely statistical method to determine the beginning year of each sustained acceleration. A natural question is, what caused the observed reallocation of resources and faster growth? As discussed in Section I, many sustained accelerations are associated with large-scale economic reforms, and our model dynamics are triggered by reforms that remove or reduce idiosyncratic distortions. Several descriptive studies—referenced below—confirm that major misallocation-reducing reforms took place around the statistically identified starting point of the four sustained accelerations.

In Chile, the government started a round of reforms in 1985 (year 0 above) that included the privatization of state-owned enterprises and the reversal of protective measures imposed during the 1982 crisis (Bosworth, Dornbusch, and Labán 1994).

In China, the Communist Party instituted the "socialist market economy" as the principle of economic reform in 1992 (year 1 above). The reforms eased restrictions on private enterprises, going beyond rural township and village enterprises and special development zones. They also removed price controls (Qian 2000; Chow 2007).

In India, although less widely celebrated than the reform of 1991, a sweeping liberalization was enacted from 1985 (year 2 above), earning the moniker

[38] Using Portuguese data, Castro and Clementi (2009) reports downward trends in the dispersion of average labor revenue productivity and also in its correlation with establishment size (i.e., employment). The trends start around 1984, the statistically identified beginning of Portugal's sustained acceleration. However, the data do not contain measures of capital stock, and the construction of TFPR or TFPQ is not possible.

"liberalization by stealth." Import controls were drastically curtailed through the expansion of Open General Licensing and abolishment of import monopoly rights. Industrial controls were relaxed through delicensing (25 industries in 1985) and raised thresholds (by more than a hundredfold in terms of firms' assets) at which size restrictions begin to apply. In addition, a tax reform replacing multi-point excise tax with value-added tax reduced input distortions (Panagariya 2008).

In Korea, in 1982 (year -1 above), a major economic reform started to undo the heavy and chemical industry promotion of the late 1970s. The government ceased directed subsidies and aided the "rationalization" of these industries through mergers and acquisitions, eventually delegating the role of investment planning to the private sector. Entry of small and medium-sized firms was also deregulated (Sakong and Koh 2010).[39]

Based on these descriptions, we find it reasonable to think that real-world reforms played an important role in the reduction of idiosyncratic distortions in the data, by relaxing government controls and ushering in more market forces. We nevertheless acknowledge that there exists only scattered direct evidence justifying the way we model the initial state of the economy and the distortion-removing reforms. A more systematic documentation of these facts over a broader set of countries is left for future work.

D. *Saving Motives: Role of Stochastic Productivity*

In Sections IVA–IVC, we emphasized the role of self-financing, permanent income saving, and precautionary saving. We further clarify the relative importance of different saving motives by considering an exercise in which we nearly shut down the idiosyncratic risk embodied in the entrepreneurial productivity, z.

In our model, self-financing per se does not generate saving in excess of investment. This is because of the way we specified the credit constraint (4). A unit increase in net worth a raises the upper bound on capital rental $\bar{k}$ by more than one unit, implying a larger increase in investment than saving for constrained entrepreneurs. It would still be possible for self-financing to generate excess saving over investment at the aggregate level, if we have enough productive-but-poor individuals saving up assets for self-financing purpose *before* starting their business. However, $\bar{k}$ is strictly positive even for those with $a = 0$, and in our benchmark even such poor individuals start their business as soon as they receive high enough a z-shock realization without waiting until they have enough collateral.[40]

The excess saving over investment in our model comes from permanent income and precautionary saving motives. Because of the mean reversion in the z-process, those with high z accumulate assets to smooth future consumption, well beyond the point at which collateral constraints cease to bind and their net investment is zero.

[39] To follow up on the preceding footnote, Castro and Clementi (2009) documents a large-scale, distortion-reducing reform in Portugal as it joined the EEC in 1986.

[40] This is one of the differences between the main driving forces of our model and those of Song, Storesletten, and Zilibotti (2011), where would-be entrepreneurs are assumed to spend half their working life saving up net worth before they can start investing in their business.

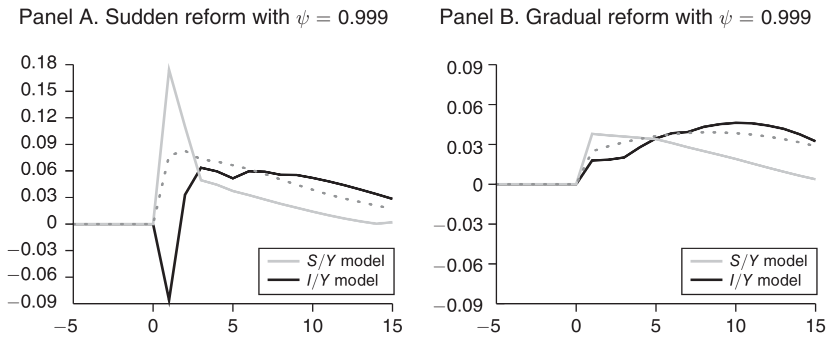

Figure 7. Post-reform Transition with Near-Constant z-Process

Note: The dotted lines are the model saving rates from Figure 2 (in panel A) and from Figure 5 (in panel B).

Those who are subsidized in the pre-reform economy also contribute to excess saving for similar reasons right after the reform. With the sudden elimination of subsidies (Section IVA), their wealth—a source of comparative advantage in entrepreneurship—and higher future wages imply that their entrepreneurial profits are temporarily high. As a result, they save to smooth consumption over time, even as they disinvest in preparation of the eventual exit. With the gradual reform (Section IVC), they play an even larger role in excess saving. Because they lose subsidy probabilistically over time, they expect a steep fall in earnings and have a stronger permanent income and precautionary saving motive.

In an effort to more clearly assess the relative contribution of the forces behind the aggregate saving, we re-do the sudden and gradual reform exercises with the stochastic entrepreneurial process virtually shut down.

Sudden Reform with Near-Constant z-Process.—We stop short of completely eliminating the only idiosyncratic risk in the benchmark, and instead increase the persistence parameter of the z-process, ψ, from 0.894 to 0.999, so that we still have a well-defined stationary distribution. Now there is very little risk for individuals conditioning on their current z. Because of our shock process specification (Section IIIA), the increase in persistence does not alter the cross-sectional z distribution.

In this exercise, we hold all other parameters—including those for initial distortions and financial frictions—at their values in Section IVA. We then construct the initial pre-reform steady state, the terminal steady state, and the post-reform transition dynamics. One consequence is that the tax revenues are not equal to the total idiosyncratic subsidies in the pre-reform economy. Here we treat $\varsigma_{i,t}$ and τ as generic idiosyncratic distortions rather than literally as taxes and subsidies. Both the initial and terminal steady states in this exercise are different from those in Section IVA. Nevertheless, the results, as shown in Figure 7, offer a generalizable economic insight.

Comparing the left panel of Figure 7 with the center panel of Figure 2, we make two observations. First, the aggregate saving dynamics with $\psi = 0.999$ are much more fronted-loaded. (The model saving rates from Figure 2 are reproduced with a dotted line in the left panel of Figure 7.) Second, the aggregate investment rates behave similarly, although they rebound slightly faster with $\psi = 0.999$. (We do not reproduce the Figure 2 investment rates lest should the figure be overcrowded.)

In the benchmark of Section IVA, several disparate forces—compositional effect, self-financing, permanent income saving, and precautionary saving—drive the aggregate saving. With the near-permanent entrepreneurial productivity, self-financing plays a more important role in the post-reform aggregate saving dynamics. When the reform eliminates taxes and subsidies, those who were previously taxed see a near-permanent jump in their maximal-profit scale of production. Because of the collateral constraint, to increase their capital input, they must increase their collateral (i.e., wealth). They make a fuller, faster adjustment given the near-permanence of the productivity process. The response of those who lose subsidy is not symmetric: They dis-save slowly to smooth their consumption over time. As a result, the aggregate saving rate rises sharply immediately after the reform. Once the previously taxed entrepreneurs accumulate enough collateral, because the permanent income and precautionary saving motives are negligible with $\psi = 0.999$, their saving rates decline quickly. In summary, with self-financing as the dominant saving motive, we observe a quick adjustment in wealth holdings by the previously taxed entrepreneurs, which explains the short-lived spike in saving rates after the reform. Although self-financing per se cannot generate excess saving, coupled with the disinvestment by those losing subsidy, capital flows out for two years and then reverses its direction.

By contrast, with $\psi = 0.894$, the self-financing motive does not warrant as quick an adjustment because there is a non-negligible probability that returns on additional saving will be low (i.e., if hit by a negative productivity shock). Furthermore, because of the idiosyncratic risk, the permanent income and precautionary saving motives are still important and elicit more persistent adjustment in wealth. As a consequence, capital flows out for seven years following the sudden reform (center panel of Figure 2).

Gradual Reform with Near-Constant z-Process.—We start from the above initial condition, but now the mass of subsidy recipients are given by $\lambda_t = \lambda \varpi^t$ for $t \geq 0$ as in Section IVC. We use the same $\varpi = 0.88$ and, along the transition, balance the government budget, which implies declining tax rates over time.

Self-financing plays out much more gradually than with the sudden reform because the demand for capital by productive entrepreneurs rises slowly over time with the declining taxes. As in Section IVC, the key driver of aggregate saving is the permanent income and precautionary saving by the subsidy recipients, who expect to lose their subsidy with probabilty $1 - \varpi$ every period.

One thing to note is that the saving rates associated with self-financing decrease with wealth (i.e., collateral) because returns to capital are diminishing. The saving rates associated with the expected loss of subsidy also decrease as wealth gets closer to the target "buffer stock" level. As a result, as shown in the right panel of Figure 7, the aggregate saving rates monotonically decline after the initial jump, and capital flows out for only four years, compared to ten with $\psi = 0.894$ (center panel of Figure 5).

With $\psi = 0.894$, the permanent income and precautionary saving with respect to the idiosyncratic productivity risk pushes up the aggregate saving rate. More important, the churning by the z-process implies that at least some individuals' saving rates become discontinuously high in any period (i.e., those who are poor but have a high z realization), and the aggregate saving rates—reproduced with a dotted line in the right panel of Figure 7—rise for seven years before starting to fall.

We conclude that a modeling of saving behaviors that captures a variety of saving motives over realistic time horizons may be necessary for explaining the direction, magnitude, and persistence of capital flows during sustained growth accelerations. Without the idiosyncratic productivity risk, saving rates will monotonically decline after an initial upward jump and, as a result, capital will flow out only for short periods.

V. Concluding Remarks

We provide a quantitative framework to explain the joint dynamics of TFP and capital flows during sustained growth accelerations. The key difference of our approach from others in the literature is that we endogenize the TFP process. It reflects the unwinding of initial misallocation, intermediated through imperfect domestic financial markets. Capital flows out because of the surge in saving—driven by entrepreneurs' permanent income saving and self-financing motive—and the initial drop and sluggish rebound of investment—a direct consequence of the financial frictions. Our analysis in Sections IVA and IVB shows that one needs to first evaluate the workings of domestic financial markets when projecting the effects of reforms that reduce idiosyncratic distortions.

In our analysis, we do not distinguish capital flows by type, e.g., debt versus equity flows. In recent years, some developing countries have accumulated debt claims on foreigners while receiving foreign direct investment (Lane and Milesi-Ferretti 2007). We conjecture that an extension of our model that allows for the joint mobility of capital and entrepreneurial talent can explain such a pattern. As in the present paper, we would observe capital in the form of debt contracts flow out of economies with underdeveloped local financial markets. At the same time, there will be wealthy foreign entrepreneurs who can bring their own capital or collateral into developing countries to take advantage of lower production costs. This extension will also enable us to study the migration of talented-but-undercapitalized entrepreneurs into countries with more developed local financial markets, a phenomenon resembling what is often referred to as "brain drain."

Appendix

A. *List of Growth Accelerations*

Sustained accelerations		Temporary accelerations		
Pre-1980	Post-1980	Pre-1980	Post-1980	
Denmark (1957)	Turkey (1981)	Morocco (1957)	Swaziland (1984)	Romania (2001)
Nigeria (1957)	UK (1982)	New Zealand (1958)	Thailand (1987)	Slovakia (2001)
Thailand (1957)	Spain (1983)	Peru (1959)	Indonesia (1988)	Thailand (2001)
Egypt (1958)	India (1983)	Pakistan (1960)	Malaysia (1988)	Angola (2002)
Spain (1958)	Korea (1983)	Zambia (1962)	Argentina (1990)	Azerbaijan (2002)
Ireland (1958)	Mauritius (1983)	Malawi (1962)	Syria (1990)	China (2002)
Japan (1958)	Portugal (1984)	Turkey (1964)	Norway (1992)	India (2002)
Belgium (1959)	Taiwan (1985)	Israel (1966)	Finland (1994)	Indonesia (2002)
Greece (1959)	Chile (1985)	Zimbabwe (1966)	Mozambique (1995)	Macedonia (2002)
Portugal (1959)	Ireland (1987)	Colombia (1967)	Botswana (1996)	Peru (2002)
Taiwan (1960)	Panama (1988)	Dom. Rep. (1968)	Cambodia (1996)	Turkey (2002)
USA (1960)	Singapore (1988)	Nigeria (1968)	Belarus (1997)	Laos (2003)
Canada (1962)	Laos (1988)	Gabon (1969)	Croatia (1997)	Malawi (2003)
Mexico (1962)	Sri Lanka (1990)	Brazil (1970)	Kazakhstan (1997)	Uzbekistan (2003)
Korea (1963)	Vietnam (1990)	Ecuador (1970)	Slovenia (1997)	Argentina (2004)
Costa Rica (1964)	China (1991)	Cameroon (1971)	Bulgaria (1999)	Dom. Rep. (2004)
Thailand (1964)	Dom. Rep. (1991)	Lesotho (1971)	Estonia (1999)	Ethiopia (2004)
Japan (1965)	El Salvador (1991)	Mali (1972)	Greece (1999)	Ghana (2004)
Panama (1965)	Albania (1993)	Paraguay (1973)	Hungary (1999)	Sri Lanka (2004)
Botswana (1967)	Poland (1993)	Syria (1973)	Morocco (1999)	Panama (2004)
Congo (1967)	Sudan (1993)	Uruguay (1973)	Russia (1999)	Turkmenistan (2004)
Finland (1967)	Trin. and Tob. (1994)	Trin. and Tob. (1974)	Chad (1999)	Uruguay (2004)
Indonesia (1967)		Jordan (1975)	Tanzania (1999)	
Malaysia (1967)		Rwanda (1975)	Armenia (2000)	
Singapore (1967)		Cameroon (1976)	Latvia (2000)	
Tunisia (1967)		Congo (1977)	Nigeria (2000)	
Mauritius (1970)		Panama (1977)	Czech Rep. (2001)	
Romania (1970)			Hong Kong (2001)	
Chile (1974)			Jordan (2001)	
China (1976)			Lithuania (2001)	
Sri Lanka (1976)			Mongolia (2001)	
Egypt (1977)			Namibia (2001)	
Laos (1978)			Pakistan (2001)	

Source: Authors' calculations

B. *Predicting Growth Accelerations*

Applying the method of Hausmann et al. (2005) to our expanded and updated sample, we run probits where the dependent dummy variable takes the value one in the three years centered on the first year of a growth acceleration. The explanatory variables include: Terms of Trade Shock, a dummy variable taking the value one whenever the change in the terms of trade from year $t - 4$ to t is in the top decile of the entire sample; Positive Political Change, a dummy variable taking the value of one in the five-year period beginning with an increase in the polity score in the Polity IV database; Negative Political Change, similarly defined for a decrease in the polity score; Openness Reform, which is a dummy that takes the value of one during the first five years of a transition to "openness" as measured by Sachs and Warner (1995); and Financial Reform and Credit Control Reform, which are

TABLE A1—PREDICTING SUSTAINED AND TEMPORARY GROWTH ACCELERATIONS

	Dependent variable					
	Sustained acceleration				Temporary acceleration	
	(1)	(2)	(3)	(4)	(5)	(6)
Terms of trade shock	−0.013	−0.009		0.004	0.035	0.033
	(1.18)	(0.79)		(0.24)	(2.05)	(2.02)
Positive political change	0.002	0.004	0.002	0.000	−0.002	−0.001
	(0.19)	(0.46)	(0.25)	(0.02)	(0.21)	(0.10)
Negative political change	0.018	0.003	0.000	−0.002	0.058	0.055
	(1.82)	(0.35)	(0.04)	(0.15)	(4.43)	(4.50)
Openness reform		0.075	0.062	0.056		−0.030
		(4.91)	(3.72)	(3.30)		(3.03)
Credit control reform			0.009	0.007		0.019
			(0.40)	(0.31)		(1.23)
Financial reform			0.054	0.056	0.020	0.037
			(2.88)	(2.86)	(1.15)	(1.95)
Observations	3,339	3,031	2,419	2,231	1,719	1,716
Pseudo R^2	0.065	0.081	0.077	0.084	0.063	0.084

Notes: Coefficients are marginal probabilities evaluated at the sample means. The t-statistics are reported in parentheses.

Source: Authors' calculations

similarly defined based on the index of financial market liberalization constructed by Abiad, Detragiache, and Tressel (2010).

C. *Exercises with Alternative Calibration*

Financial Frictions in the United States.—In our calibration (Section IIIA), we assumed that the United States has a perfect credit market ($\phi = 1$). This assumption enables an aggregation result for the production side, which helps a transparent calibration of the relevant parameters.

We now consider financial frictions in the United States and recalibrate the preference and technology parameters. The model has a corporate sector and an entrepreneurial sector. We maintain the assumption that the model corporate sector is not subject to financial frictions. We assume that the data counterpart of the unconstrained corporate sector is the publicly traded firms in the United States. Accordingly, the financially-constrained entrepreneurial sector in the model is assumed to correspond to the private firms in the United States.

This recalibration follows the procedure described in Section IIIA, with two exceptions. First, we now choose ϕ to match the data counterpart of the ratio of external finance to output for the entrepreneurial sector. Drawing on the Flow of Funds and the data on private firms compiled by Asker, Farre-Mensa, and Ljungqvist (2011), we compute that private firms' debt to value added ratio is 0.98. We also utilize the fact that publicly traded firms account for 48 percent of the total capital stock in the nonfinancial business sector in the United States. Second, we leave the discount factor ($\beta = 0.92$) and the world interest rate ($r^* = 0.04$) as before.

One challenge is that we do not have data on establishment size distributions separately for public and private firms. In addition, in the model, the establishment size distribution within the unconstrained corporate sector is indeterminate because of the constant-returns production function. In computing the employment concentration in the data and the model, we assume that the two sectors have the same within-sector establishment size distribution.

The alternate joint calibration results in the following parameter values: $\phi = 0.48$, $\eta = 4.98$, $\alpha + \theta = 0.81$, and $\psi = 0.89$. The changes in η and $\alpha + \theta$ from their values in Table 2 have a ready interpretation. All else equal, financial frictions increase the entrepreneurial profit share, because the rental rate of capital is lower than its marginal product for constrained entrepreneurs. To match the top earnings share, $\alpha + \theta$ must increase. The higher span-of-control then implies more employment concentration at the top, necessitating a higher η to match the top 10 percent employment share.

Given the new parameter values, we construct the pre-reform economy as in Section IIIB and conduct the benchmark transition exercise as in Section IVA. The resulting transition dynamics are virtually indistinguishable from what is reported in Figure 2 (and are hence not shown here). There are two reasons why the transition results are robust to this recalibration. First, we found that the effect of ϕ on other jointly-calibrated parameters diminish as ϕ increases: While other parameters are sensitive to ϕ when it is close to zero (e.g., less than 0.35), they are fairly unresponsive when it goes from 0.48 to 1. Second, the financial frictions in the United States only matter for pinning down technology parameters that are common across economies. We still calibrate the transition economies' ϕ and initial distortion parameters using their own data. In particular, their ϕ is still 0.12, even with the recalibration of technology parameters. Because the transition dynamics depend primarily on the degree of the initial misallocation and the severity of the financial frictions that remain after the removal of idiosyncratic distortions, the small changes in the technology parameters have no discernible effect on the post-reform transition dynamics of the economies being considered.

Domestic Financial Frictions and Capital Flows.—Comparing the results in Sections IVA and IVB, it becomes apparent that the direction of capital flows during growth accelerations depends on the workings of the local financial markets: Severe local frictions (i.e., a low ϕ) lead to capital outflows, and well-functioning financial markets (i.e., a high ϕ) to capital inflows.

Here we numerically analyze in more detail how ϕ affects the direction and magnitude of capital flows. We start with the same initial conditions as in Sections IVA and IVB. In period 0, a completely unexpected reform eliminates all taxes and subsidies at once. As in Section IVB, the reform also partially improves the local financial markets, which is captured in the model by an increase in ϕ. In Figure A1, we show the net capital outflows (saving minus investment) relative to GDP during the post-reform transitions. Although not shown in the figure, TFP grows rapidly over time in all of the post-reform transitions.

The solid gray line reproduces the benchmark exercise, in which $\phi = 0.121$ is unaffected by the reform (Section IVA). Capital flows out for seven years following

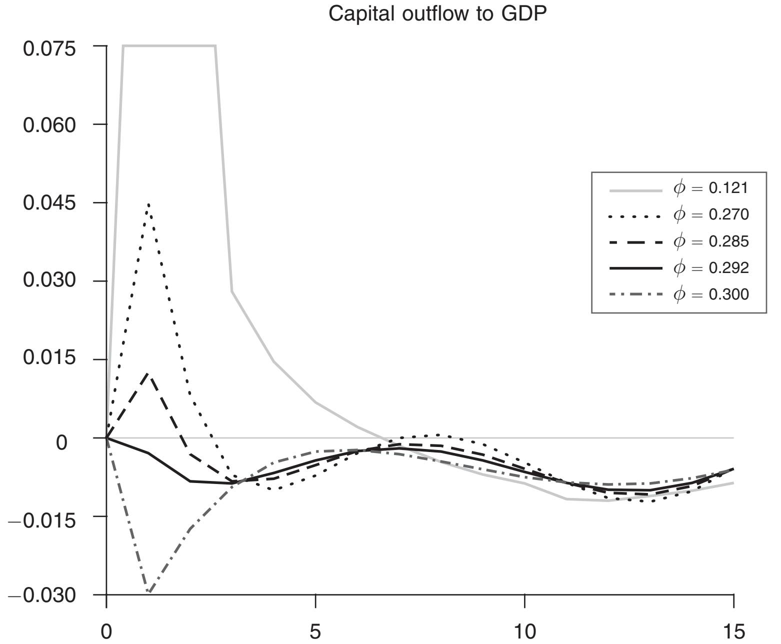

Figure A1. Sudden Distortion Elimination and Domestic Financial Reform

the reform. For joint reforms of idiosyncratic tax/subsidy and financial frictions that raise ϕ to 0.270 or 0.285, capital flows out by a much smaller amount and also for a shorter period of time. With $\phi = 0.292$, the growth acceleration is accompanied by negligible capital flows, as if the post-reform transition took place in a closed economy. With $\phi = 0.3$, now the growth acceleration is accompanied by a significant amount of capital inflows, as in Section IVB.

This robustness exercise underscores the main thesis of the paper. A rapid increase in TFP reflecting more efficient reallocation of economic resources can be accompanied by capital flows of different directions and magnitudes depending on the domestic financial market conditions. If the local financial markets cannot effectively intermediate the necessary capital reallocation that drives up TFP, capital will flow out.

REFERENCES

Abiad, Abdul, Enrica Detragiache, and Thierry Tressel. 2010. "A New Database of Financial Reforms." *IMF Staff Papers* 57 (2): 281–302.

Aguiar, Mark, and Manuel Amador. 2011. "Growth in the Shadow of Expropriation." *Quarterly Journal of Economics* 126 (2): 651–97.

Angeletos, George-Marios, and Vasia Panousi. 2011. "Financial integration, entrepreneurial risk and global dynamics." *Journal of Economic Theory* 146 (3): 863–96.

Asker, John, Joan Farre-Mensa, and Alexander Ljungqvist. 2011. "Comparing the Investment Behavior of Public and Private Firms." National Bureau of Economic Research (NBER) Working Paper 17394.

Bartelsman, Eric J., John C. Haltiwanger, and Stefano Scarpetta. 2009. "Cross-Country Differences in Productivity: The Role of Allocation and Selection." National Bureau of Economic Research (NBER) Working Paper 15490.

Beck, Thorsten, Asli Demirgüç-Kunt, and Ross Levine. 2000. "A New Database on the Structure and Development of the Financial Sector." *World Bank Economic Review* 14 (3): 597–605.

Benhima, Kenza. 2013. "A reappraisal of the allocation puzzle through the portfolio approach." *Journal of International Economics* 89 (2): 331–46.

Bosworth, Barry P., Rudiger Dornbusch, and Raúl Labán. 1994. *The Chilean Economy: Policy Lessons and Challenges.* Washington, DC: Brookings Institution Press.

Boyd, John H., and Bruce D. Smith. 1997. "Capital Market Imperfections, International Credit Markets, and Nonconvergence." *Journal of Economic Theory* 73 (2): 335–64.

Buera, Francisco J., Joseph P. Kaboski, and Yongseok Shin. 2011. "Finance and Development: A Tale of Two Sectors." *American Economic Review* 101 (5): 1964–2002.

Buera, Francisco J., Benjamin Moll, and Yongseok Shin. 2013. "Well-intended policies." *Review of Economic Dynamics* 16 (1): 216–30.

Buera, Francisco J., and Yongseok Shin. 2013. "Financial Frictions and the Persistence of History: A Quantitative Exploration." *Journal of Political Economy* 121 (2): 221–72.

Buera, Francisco J., and Yongseok Shin. 2017. "Productivity Growth and Capital Flows: The Dynamics of Reforms: Dataset." *American Economic Journal: Macroeconomics*. https://doi.org/10.1257/mac.20160307.

Caballero, Ricardo J., Emmanuel Farhi, and Pierre-Olivier Gourinchas. 2008. "An Equilibrium Model of 'Global Imbalances' and Low Interest Rates." *American Economic Review* 98 (1): 358–93.

Camdessus, Michel. 1999. "Second Generation Reforms: Reflections and New Challenges." Opening Remarks to IMF Conference on Second Generation Reforms, Washington, DC, November 8.

Carroll, Christopher D., and Olivier Jeanne. 2009. "A Tractable Model of Precautionary Reserves, Net Foreign Assets, or Sovereign Wealth Funds." National Bureau of Economic Research (NBER) Working Paper 15228.

Carroll, Christopher D., Jody Overland, and David N. Weil. 2000. "Saving and Growth with Habit Formation." *American Economic Review* 90 (3): 341–55.

Caselli, Francesco, and James Feyrer. 2007. "The Marginal Product of Capital." *Quarterly Journal of Economics* 122 (2): 535–68.

Castro, Rui, and Gian Luca Clementi. 2009. "The economic effects of improving investor rights in Portugal." *Portuguese Economic Journal* 8 (2): 59–97.

Castro, Rui, Gian Luca Clementi, and Glenn MacDonald. 2004. "Investor Protection, Optimal Incentives, and Economic Growth." *Quarterly Journal of Economics* 119 (3): 1131–75.

Chen, Kaiji, and Alfonso Irarrazabal. 2015. "The role of allocative efficiency in a decade of recovery." *Review of Economic Dynamics* 18 (3): 523–50.

Chow, Gregory C. 2007. *China's Economic Transformation.* 2nd ed. Malden, MA: Blackwell Publishing.

Feldstein, Martin, and Charles Horioka. 1980. "Domestic Saving and International Capital Flows." *Economic Journal* 90 (358): 314–29.

Gertler, Mark, and Kenneth Rogoff. 1990. "North-South lending and endogenous domestic capital market inefficiencies." *Journal of Monetary Economics* 26 (2): 245–66.

Gourinchas, Pierre-Olivier, and Olivier Jeanne. 2007. "Capital Flows to Developing Countries: The Allocation Puzzle." National Bureau of Economic Research (NBER) Working Paper 13602.

Guner, Nezih, Gustavo Ventura, and Yi Xu. 2008. "Macroeconomic implications of size-dependent policies." *Review of Economic Dynamics* 11 (4): 721–44.

Hausmann, Ricardo, Lant Pritchett, and Dani Rodrik. 2005. "Growth Accelerations." *Journal of Economic Growth* 10 (4): 303–29.

Hopenhayn, Hugo, and Richard Rogerson. 1993. "Job Turnover and Policy Evaluation: A General Equilibrium Analysis." *Journal of Political Economy* 101 (5): 915–38.

Hsieh, Chang-Tai, and Peter J. Klenow. 2009. "Misallocation and Manufacturing TFP in China and India." *Quarterly Journal of Economics* 124 (4): 1403–48.

Kaminsky, Graciela Laura, and Sergio L. Schmukler. 2008. "Short-Run Pain, Long-Run Gain: Financial Liberalization and Stock Market Cycles." *Review of Finance* 12 (2): 253–92.

Kim, Minho, Jiyoon Oh, and Yongseok Shin. 2017. "Misallocation and Manufacturing TFP in Korea, 1982–2007." *Federal Reserve Bank of St. Louis Review* 99 (2): 233–44.

Lane, Philip R., and Gian Maria Milesi-Ferretti. 2007. "The external wealth of nations mark II: Revised and extended estimates of foreign assets and liabilities, 1970–2004." *Journal of International Economics* 73 (2): 223–50.

Lucas, Robert E., Jr. 1990. "Why Doesn't Capital Flow from Rich to Poor Countries?" *American Economic Review* 80 (2): 92–96.

Mendoza, Enrique G., Vincenzo Quadrini, and José-Victor Ríos-Rull. 2009. "Financial Integration, Financial Development, and Global Imbalances." *Journal of Political Economy* 117 (3): 371–416.

Mishkin, Frederic S., Andrew Crockett, Michael P. Dooley, and Montek S. Ahluwalia. 2003. "Financial Policies." In *Economic and Financial Crises in Emerging Market Economies*, edited by Martin Feldstein, 93–154. Chicago: University of Chicago Press.

Obstfeld, Maurice. 2008. "International Finance and Growth in Developing Countries: What Have We Learned?" World Bank Commission on Growth and Development Working Paper 34.

Panagariya, Arvind. 2008. *India: The Emerging Giant.* Oxford: Oxford University Press.

Prasad, Eswar S., Raghuram G. Rajan, and Arvind Subramanian. 2007. "Foreign Capital and Economic Growth." *Brookings Papers on Economic Activity* 37 (1): 153–209.

Qian, Yingyi. 2000. "The Process of China's Market Transition (1978–1998): The Evolutionary, Historical, and Comparative Perspectives." *Journal of Institutional and Theoretical Economics* 156 (1): 151–71.

Restuccia, Diego, and Richard Rogerson. 2008. "Policy distortions and aggregate productivity with heterogeneous establishments." *Review of Economic Dynamics* 11 (4): 707–20.

Sachs, Jeffrey D., and Andrew Warner. 1995. "Economic Reform and the Process of Global Integration." *Brookings Papers on Economic Activity* 25 (1): 1–118.

SaKong, Il, and Youngsun Koh, eds. 2010. *The Korean Economy: Six Decades of Growth and Development*. Seoul: Korea Development Institute.

Sandri, Damiano. 2014. "Growth and Capital Flows with Risky Entrepreneurship." *American Economic Journal: Macroeconomics* 6 (3): 102–23.

Song, Zheng, Kjteil Storesletten, and Fabrizio Zilibotti. 2011. "Growing Like China." *American Economic Review* 101 (1): 196–233.

Stulz, René M. 2005. "The Limits of Financial Globalization." *Journal of Finance* 60 (4): 1595–1638.

Wacziarg, Romain, and Karen Horn Welch. 2003. "Trade Liberalization and Growth: New Evidence." National Bureau of Economic Research (NBER) Working Paper 10152.