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The Global Financial Resource Curse[†]

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We provide a model connecting the global saving glut to productivity growth. The key feature is that the tradable sector is the engine of growth of the economy. Capital flows from developing countries to the United States boost demand for US nontradable goods, inducing a reallocation of US economic activity from the tradable sector to the nontradable one. In turn, lower profits in the tradable sector lead firms to cut back investment in innovation. Since innovation in the United States determines the evolution of the world technological frontier, the result is a drop in global productivity growth. (*JEL* E21, E22, E23, E44, F32, F43, O31)

There is a large literature in international macroeconomics studying the impact of productivity growth on the pattern of international capital flows. In this paper, we reverse this classic perspective by considering how international capital flows shape global productivity growth. We are motivated by the fact that since the late 1990s the United States has received large capital flows from developing countries, mainly China and other Asian countries, a phenomenon known as the global saving glut (Figure 1, panel A). Although much has been written about the causes and macroeconomic consequences of this saving glut, its implications for global productivity growth are yet poorly understood.

Conventional wisdom suggests that cheap capital inflows should help firms to finance investment and increase their productivity. One could then expect that the global saving glut coincided with a rise in US investment and productivity growth. Since the early 2000s, however, the United States has experienced a productivity

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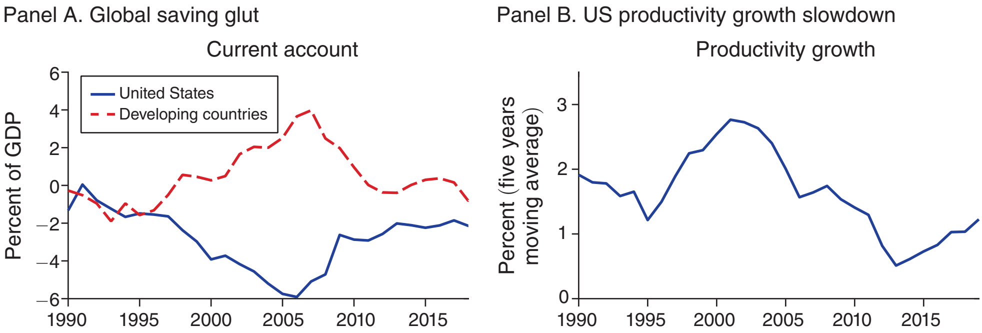

Figure 1. Motivating Facts

Notes: The left panel shows the large current account deficits experienced by the United States since the late 1990s, accompanied by current account surpluses from developing countries. The right panel illustrates the productivity growth slowdown affecting the United States since the early 2000s. See online Appendix A for the procedure used to construct these figures.

growth slowdown (Figure 1, panel B).[1] Moreover, the international evidence shows that episodes of large capital inflows are often followed by slowdowns in productivity growth, calling into question the conventional logic.[2] So could it be that capital flows from developing countries to the United States ended up not contributing much, or even depressing, US productivity growth? If so, given the United States' status as one of the world technological leaders, what would be the effect of the saving glut on global growth?

In this paper, we tackle these questions by providing two main contributions. First, we develop a novel endogenous growth model to study the impact of international financial integration on global productivity growth.[3] Second, we explore a channel through which a global saving glut originating from developing countries may, perhaps paradoxically, depress productivity growth in the United States, and eventually in the rest of world as well. For reasons that will become clear below, we dub this effect the global financial resource curse.

Our model is composed of two regions: the United States and developing countries. As in standard models of technology diffusion (Krugman 1979; Grossman and Helpman 1991), innovation activities by the technological leader, i.e., the United States, determine the evolution of the world technological frontier. Developing countries, in contrast, grow by absorbing knowledge originating from the United States. Therefore, investments by firms in developing countries affect their proximity to the technological frontier.

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[1] Of course, the literature has described several factors—independent of capital flows—that have contributed to the US productivity growth slowdown. We discuss the relationship of our paper to this body of work in the literature review, at the end of the introduction.

[2] For instance, Gourinchas and Jeanne (2013) observe that among developing countries the fast growers are typically characterized by capital outflows, while slow growers tend to receive capital inflows. Benigno and Fornaro (2014) and Gopinath et al. (2017) discuss the case of euro area peripheral countries during the first ten years of the euro, in which large capital inflows have coincided with productivity growth slowdowns.

[3] To clarify, in this paper we are interested in isolating the impact of financial integration on global growth. We abstract, instead, from other forces commonly linked to globalization, most notably trade integration. Hence, throughout our analysis we hold the level of trade integration constant.

Compared to standard frameworks of technology diffusion, our model has two novel features. The first one is that sectors producing tradable goods are the engine of growth in our economy. That is, in both regions productivity growth is the result of investment by firms operating in the tradable sector. The nontradable sector, instead, is characterized by stagnant productivity growth. As we explain in more detail below, this assumption captures the notion that sectors producing tradable goods, such as manufacturing, have more scope for productivity improvements compared to sectors producing nontradables, for instance construction.[4] The second feature is that agents in developing countries have a higher propensity to save compared to that of the United States. Again as we discuss below, the literature has highlighted a host of factors contributing to high saving rates in developing countries, such as demography, lack of insurance or government interventions.

Against this background, we consider a global economy moving from a regime of financial autarky to international financial integration. Due to the heterogeneity in propensities to save across the two regions, once financial integration occurs the United States receives capital inflows from developing countries. Capital inflows allow US agents to finance an increase in consumption. Higher consumption of tradables is achieved by increasing imports of tradable goods from developing countries, and so the United States ends up running persistent trade deficits. But nontradable consumption goods have to be produced domestically. Hence, in response to the rise in demand for nontradable goods, factors of production migrate from the tradable sector toward the nontradable one. As the share of global demand captured by tradable firms in the United States declines, their profits drop, reducing their incentives to invest in innovation. The consequent drop in investment results in a slowdown in US productivity growth. Therefore, in contrast with the conventional wisdom, cheap capital inflows depress investment and productivity growth, because they end up financing a boom in the nontradable sector.[5]

To some extent, developing countries experience symmetric dynamics compared to the United States. Financial integration leads developing countries to run persistent trade surpluses. This stimulates economic activity in the tradable sector, at the expense of the nontradable one. In turn, higher profits in the tradable sector induce firms in developing countries to increase their investment in technology adoption. The proximity of developing countries to the technological frontier thus rises. But this does not necessarily mean that financial integration benefits productivity growth in developing countries. Following financial integration, indeed, productivity growth in developing countries initially accelerates, but then it slows down below its value under financial autarky. The explanation is that the drop in innovation activities in the United States reduces the productivity gains that developing countries can obtain by absorbing knowledge from the frontier. Therefore, in the long run the process of financial integration—and the associated saving glut—generates a fall in global productivity growth.

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[4] In online Appendix G we explore a version of the model in which productivity grows endogenously also in the nontradable sector. There we show that our key results hold, as long as the tradable sector is characterized by faster productivity growth than the nontradable one. This is the case in the data.

[5] In the model, a second force is at work. Capital inflows lower firms' cost of funds, thus fostering their incentives to invest. However, as we will show, this effect is dominated by the fall in the return to investment caused by lower economic activity and profits in the tradable sector.

Perhaps paradoxically, in our framework cheap access to foreign capital by the world technological leader depresses global productivity growth in the long term. The reason is that capital inflows lead to a contraction in economic activity in tradable sectors, which are the engine of growth in our economies. In this respect, our model is connected to the idea of natural resource curse (Krugman 1987; Van der Ploeg 2011). However, our mechanism is based on financial, rather than natural, resources. Moreover, the forces that we emphasize are global in nature. In fact, lower innovation by the technological leader drives down productivity growth also in the rest of the world, including in those countries experiencing capital outflows and an expansion of their tradable sectors. For these reasons, we refer to the link between capital flows toward the world technological leader and weak global growth as the *global financial resource curse*.

Relatedly, it has been argued that the United States' ability to attract foreign capital represents an exorbitant privilege, which benefits US citizens by allowing them to consume more than what they produce. Our model paints a more nuanced picture, in which the impact of capital inflows on welfare is a priori ambiguous. The reason is that capital inflows may exacerbate private firms' tendency to underinvest in innovation and knowledge creation compared to the social optimum. When this effect is strong enough, capital inflows end up lowering welfare, and the exorbitant privilege morphs into an exorbitant burden.[6]

Our model also helps to rationalize the sharp decline in global rates observed over the last three decades. Some commentators have claimed that the integration of high-saving developing countries in global credit markets has contributed to depress interest rates around the world, by triggering a global saving glut (Bernanke 2005). This effect is also present in our framework, but in a magnified form. In standard models, after two regions integrate financially the equilibrium interest rate lies somewhere between the two autarky rates. In our model, instead, financial integration induces a drop in the equilibrium interest rate below both autarky rates. In fact, lower global growth leads agents to increase their saving supply, exerting downward pressure on interest rates. Because of this effect, financial integration and the global saving glut lead to a regime of super low global rates, in which investment and productivity growth are depressed.

We then provide evidence in support of the economic forces highlighted by our model. First we show that in the data capital inflows are associated with lower economic activity in the manufacturing sector and lower productivity growth. These empirical correlations are in line with our notion of financial resource curse. Second, we perform a quantitative analysis by calibrating our model to match some key statistics for the United States. The robust result of this exercise is that capital inflows may trigger a substantial decline in economic activity in the tradable sector and in aggregate productivity growth. The precise magnitude of these effects, however, depends on how the innovation process is specified.

In the last part of the paper, we revisit some prominent debates in international macroeconomics. First we consider the impact of capital inflows from developing countries to the United States on the dollar (Obstfeld and Rogoff 2005). We show

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[6] Our concept of exorbitant burden is related to the view put forward by Pettis (2011), that the exorbitant privilege hurts the United States by reducing the competitiveness of its manufacturing sector.

that the response may be nonmonotonic, and characterized by an initial appreciation of the dollar, giving way to a depreciation in the medium to long run. We then consider export-led growth by developing countries, that is the idea that technology adoption can be fostered by policies that stimulate trade balance surpluses and capital outflows (Dooley, Folkerts-Landau, and Garber 2004). We argue that export-led growth might be successful at raising productivity growth in developing countries in the medium run. However, this comes at the expenses of a fall in innovation activities in the United States, which eventually produces a drop in global productivity growth. We finally turn to innovation policies. We show that policies that sustain innovation activities can play a crucial role in insulating United States—and more broadly global—productivity growth from the adverse impact of the global saving glut.

Related Literature.—This paper unifies two strands of the literature that have been traditionally separated. First, there is a literature studying the macroeconomic consequences of financial globalization, and in particular of the integration of high-saving developing countries in the international financial markets. For instance, Caballero et al. (2008) and Mendoza, Quadrini, and Rios-Rull (2009) provide models in which the integration of developing countries in global credit markets leads to an increase in the global supply of savings and a fall in global rates. Caballero et al. (2021); Eggertsson et al. (2016); and Fornaro and Romei (2019) show that in a world characterized by deficient demand financial integration can lead to a fall in global output. This paper contributes to this literature by studying the impact of the global saving glut on global productivity growth.

Second, there is a vast literature on the impact of globalization on productivity growth. One part of this literature has argued that globalization increases global productivity growth by facilitating the flow of ideas across countries (Howitt 2000). Another body of work has focused on the impact of trade globalization on productivity (Grossman and Helpman 1991; Rivera-Batiz and Romer 1991; Atkeson and Burstein 2010; Akcigit, Ates, and Impullitti 2018; Cuñat and Zymek 2019). We complement this literature by studying the impact of *financial globalization* on productivity growth.

The paper is also related to a third literature, which connects capital flows to productivity. In Ates and Saffie (2021); Benigno, Fornaro, and Wolf (2022); and Queralto (2020) sudden stops in capital inflows depress productivity growth. In Gopinath et al. (2017) and Cingano and Hassan (2019) capital flows affect productivity by changing the allocation of capital across heterogeneous firms. Studying an episode of capital account liberalization in Hungary, Varela (2018) finds that better access to credit helped financially constrained firms to increase their investment in technology adoption and their productivity.[7] Rodrik (2008); Benigno, Fornaro, and Wolf (2022); Benigno and Fornaro (2014); and Brunnermeier, Gourinchas, and Itskhoki (2018) study single small open economies and show that capital inflows

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[7] Notice that this finding is consistent with our framework. In our model, keeping everything else constant, better access to credit fosters firms' investment in innovation. The negative relationship between capital inflows and productivity growth arises because—through a general equilibrium effect—capital inflows depress the return from investing in innovation in the tradable sector.

might negatively affect productivity by reducing innovation activities in the tradable sector.[8] Rodrik and Subramanian (2009) argue that this effect explains why the integration of developing countries in the international financial markets has been associated with disappointing growth performances. Our paper builds on this insight, but takes a global perspective. In particular, due to their impact on the world technological frontier, in our model capital flows out of developing countries can induce a drop in global productivity growth. Coeurdacier et al. (2020) study the impact of financial integration on global growth, using a two-country neoclassical growth model. Their framework focuses on capital accumulation and takes productivity growth as an exogenous force, while in our model the endogenous response of productivity growth to financial integration is crucial.

The paper is also connected to the literature studying the impact of capital flows on the sectoral allocation of production. Benigno, Converse, and Fornaro (2015) and Kalantzis (2015) analyze empirically episodes of large capital inflows, and find that they are characterized by a shift of labor and capital out of the manufacturing sector.[9] Pierce and Schott (2016) document a sharp drop in US employment in manufacturing starting from the early 2000s, and thus coinciding with the surge in capital inflows from developing countries.[10] Interestingly, over the same period, productivity growth in manufacturing fell sharply (Syverson 2016). More broadly, Mian, Sufi, and Verner (2019) show that increases in credit supply tend to boost employment in nontradable sectors at the expenses of tradable ones. In a very interesting recent paper, Müller and Verner (2023) document how credit booms geared toward the nontradable sector are typically followed by slowdowns in productivity growth, lending empirical support to one of the key mechanisms of the model. Furthermore, Richter and Diebold (2021) find that credit booms financed by foreign capital flows are particularly likely to be followed by drops in output growth in the medium run. All this evidence is consistent with the predictions of our model.

Finally, this paper contributes to the recent literature exploring the causes of the US productivity growth slowdown. This literature has focused on different possibilities, such as rising costs from discovering new ideas (Bloom et al. 2020), slower

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[8] The notion of financial resource curse, defined as the joint occurrence of large capital inflows and weak productivity growth, was introduced in Benigno and Fornaro (2014) by a subset of the authors of this paper. There are, however, stark differences between this paper and Benigno and Fornaro (2014). Benigno and Fornaro (2014) focus on a single small open economy, receiving an exogenous inflow of foreign capital. Instead, here we take a global perspective, and study the impact on the global economy of capital flows from developing countries to the technological leader. We show that in this case also those countries experiencing capital outflows, which should grow faster according to the logic of Benigno and Fornaro (2014), will eventually see their productivity growth slowing down. Moreover, in the current framework we consider the implications for global interest rates. Another difference is that in Benigno and Fornaro (2014) growth was the unintentional byproduct of learning by doing. Here, as in the modern endogenous growth literature, productivity growth is the result of investment in innovation by profit-maximizing firms.

[9] Relatedly, Broner et al. (2021) find that exogenous rises in capital inflows in developing countries are associated with lower profits earned by firms operating in the tradable sector. Saffie, Varela, and Yi (2020) find that capital inflows following the financial liberalization in Hungary in 2001 led to lower value added and employment in the manufacturing sector, but to higher value added and employment in the service sector.

[10] Of course, due to structural transformation, since the end of WWII in the United States there has been a secular decline in the manufacturing share of employment. The literature on structural transformation usually interprets the decline in manufacturing employment as the outcome of faster productivity growth in manufacturing compared to other sectors (Ngai and Pissarides 2007). Therefore, the models developed by this literature cannot explain why manufacturing has experienced a fall in both employment and productivity growth during the global saving glut. In online Appendix G, we embed structural change in our framework and show that capital inflows accelerate the decline in the manufacturing employment share, and reduce productivity growth over the medium run.

technology diffusion from frontier to laggard firms (Akcigit and Ates 2021), rising firms' entry costs (Aghion et al. 2023), falling interest rates leading to low competition (Liu, Mian, and Sufi 2022) or discouraging intangible investment financed through internal savings (Caggese and Pérez-Orive 2022), and weak aggregate demand leading to low profits from investing in innovation (Anzoategui et al. 2019; Benigno and Fornaro 2018). Our paper provides a complementary explanation, based on the interaction of capital flows and the sectoral allocation of production. Our paper is also different from this literature because it shows how cheap access to capital—which the conventional wisdom would associate with higher investment and faster growth—may surprisingly end up depressing productivity growth.

The rest of the paper is structured as follows. Section I introduces the model. Section II presents our main results, by studying the impact of financial integration on global growth. Section III provides some empirical evidence, and illustrates the quantitative properties of the framework. Section IV discusses some further implications of the model. Section V concludes. The proofs to all the propositions are collected in the online Appendix.

I. Baseline Model

Consider a world composed of two regions: the United States and a group of developing countries.[11] The two regions are symmetric except for two aspects. First, developing countries have a higher propensity to save compared to the United States. Second, innovation in the United States determines the evolution of the world technological frontier. Developing countries, instead, experience productivity growth by adopting discoveries originating from the United States. In what follows, we will refer to the United States as region u and to developing countries as region d. For simplicity, we will focus on a perfect-foresight economy. Time is discrete and indexed by $t \in \{0, 1, \dots\}$.

A. *Households*

Each region is inhabited by a measure one of identical households. The lifetime utility of the representative household in region i is

$$\sum_{t=0}^{\infty} \beta^t \log(C_{i,t}), \tag{1}$$

where $C_{i,t}$ denotes consumption and $0 < \beta < 1$ is the subjective discount factor. Consumption is a Cobb-Douglas aggregate of a tradable good $C_{i,t}^T$ and a nontradable good $C_{i,t}^N$, so that $C_{i,t} = (C_{i,t}^T)^{\omega}(C_{i,t}^N)^{1-\omega}$ where $0 < \omega < 1$. Each household is endowed with $\bar{L}$ units of labor, and there is no disutility from working.

Households can trade in one-period riskless bonds. Bonds are denominated in units of the tradable consumption good and pay the gross interest rate $R_{i,t}$. Moreover,

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[11] There is no need to specify the number of developing countries. For instance, our results apply to the case of a single large developing country, or to a setting in which there is a continuum of measure one of small open developing countries.

investment in bonds is subject to a subsidy $\tau_{i,t}$. This subsidy is meant to capture a variety of factors, such as demography or policy-induced distortions, affecting households' propensity to save. This feature of the model allows us to generate, in a stylized but simple way, heterogeneity in saving rates across the two regions. In particular, we are interested in a scenario in which developing countries have a higher propensity to save compared to the United States. We thus normalize $\tau_{u,t} = 0$ and assume that $\tau_{d,t} = \tau > 0$.[12]

The household budget constraint in terms of the tradable good is

$$C_{i,t}^{T} + P_{i,t}^{N} C_{i,t}^{N} + \frac{B_{i,t+1}}{R_{i,t}(1 + \tau_{i,t})} = W_{i,t}\bar{L} + \Pi_{i,t} - T_{i,t} + B_{i,t}. \tag{2}$$

The left-hand side of this expression represents the household's expenditure. $P_{i,t}^{N}$ denotes the price of a unit of the nontradable good in terms of the tradable one. Hence, $C_{i,t}^{T} + P_{i,t}^{N} C_{i,t}^{N}$ is the total expenditure in consumption. $B_{i,t+1}$ denotes the purchase of bonds made by the household at time t. If $B_{i,t+1} < 0$ the household is holding a debt.

The right-hand side captures the household's income. $W_{i,t}$ denotes the wage, and hence $W_{i,t}\bar{L}$ is the household's labor income. Labor is immobile across regions and so wages are region-specific. Firms are fully owned by domestic agents, and $\Pi_{i,t}$ denotes the profits that households receive from the ownership of firms. $T_{i,t}$ is a tax paid to the domestic government. We assume that governments run balanced budgets and so $T_{i,t} = \tau_{i,t} B_{i,t+1} / \left[R_{i,t}(1 + \tau_{i,t})\right]$. Finally, $B_{i,t}$ represents the return on investment in bonds made at time $t - 1$.

There is a limit to the amount of debt that a household can take. In particular, the end-of-period bond position has to satisfy

$$B_{i,t+1} \geq -\kappa_{i,t}, \tag{3}$$

where $\kappa_{i,t} \geq 0$. This constraint captures in a simple form a case in which a household cannot credibly commit in period t to repay more than $\kappa_{i,t}$ units of the tradable good to its creditors in period $t + 1$.

The household's optimization problem consists in choosing a sequence $\{C_{i,t}^{T}, C_{i,t}^{N}, B_{i,t+1}\}_t$ to maximize lifetime utility (1), subject to the budget constraint (2) and the borrowing limit (3), taking initial wealth $B_{i,0}$, a sequence for

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[12] This feature of the model captures the direction of capital flows, from developing countries to the United States, observed in the data from the late 1990s (see Figure 1, panel A). The literature has proposed several explanations for this fact. In Caballero et al. (2008) developing countries export capital to the United States because they are unable to produce enough stores of value to satisfy local demand, due to the underdevelopment of their financial markets. Mendoza, Quadrini, and Rios-Rull (2009) argue that lack of insurance against idiosyncratic shocks contributes to the high saving rates observed in several developing countries. Gourinchas and Jeanne (2013) and Alfaro, Kalemli-Özcan, and Volosovych (2014) show that policy interventions by governments in developing countries—aiming at fostering national savings—explain an important part of the capital outflows toward the United States. For our results we do not need to take a stance on the precise source of high saving rates in developing countries. Our model is thus consistent with all these possible explanations.

income $\left\{W_{i,t}\bar{L} + \Pi_{i,t} - T_{i,t}\right\}_t$, and prices $\left\{R_{i,t}(1 + \tau_{i,t}), P^N_{i,t}\right\}_t$ as given. The household's optimality conditions can be written as

$$\frac{\omega}{C^T_{i,t}} = R_{i,t}(1 + \tau_{i,t})\left(\frac{\beta\omega}{C^T_{i,t+1}} + \mu_{i,t}\right) \tag{4}$$

$$B_{i,t+1} \geq -\kappa_{i,t} \quad \text{with equality if} \quad \mu_{i,t} > 0 \tag{5}$$

$$\lim_{k\to\infty} \frac{B_{i,t+1+k}}{R_{i,t}(1 + \tau_{i,t}) \ \ldots \ R_{i,t+k}(1 + \tau_{i,t+k})} \leq 0 \tag{6}$$

$$C^N_{i,t} = \frac{1 - \omega}{\omega}\frac{C^T_{i,t}}{P^N_{i,t}}, \tag{7}$$

where $\mu_{i,t}$ is the nonnegative Lagrange multiplier associated with the borrowing constraint. Equation (4) is the Euler equations for bonds. Equation (5) is the complementary slackness condition associated with the borrowing constraint. Equation (6) is the terminal condition for bond holdings, ensuring that the household consumes asymptotically all its income.[13] Equation (7) determines the optimal allocation of consumption expenditure between tradable and nontradable goods. Naturally, demand for nontradables is decreasing in their relative price $P^N_{i,t}$. Moreover, demand for nontradables is increasing in $C^T_{i,t}$, due to households' desire to consume a balanced basket between tradable and nontradable goods.

B. *Nontradable Good Production*

The nontradable sector represents a traditional sector with limited scope for productivity improvements. The nontradable good is produced by a large number of competitive firms using labor, according to the production function $Y^N_{i,t} = L^N_{i,t}$. $Y^N_{i,t}$ is the output of the nontradable good, while $L^N_{i,t}$ is the amount of labor employed by the nontradable sector. The zero profit condition thus requires that $P^N_{i,t} = W_{i,t}$.

C. *Tradable Good Production*

The tradable good is produced by competitive firms using labor and a continuum of measure one of intermediate inputs $x^j_{i,t}$, indexed by $j \in [0,1]$. Intermediate inputs cannot be traded across the two regions.[14] Denoting by $Y^T_{i,t}$ the output of tradable good, the production function is

$$Y^T_{i,t} = \left(L^T_{i,t}\right)^{1-\alpha}\int_0^1 \left(A^j_{i,t}\right)^{1-\alpha}\left(x^j_{i,t}\right)^{\alpha} dj, \tag{8}$$

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[13] Often, this optimality condition is coupled with a constraint ruling out Ponzi schemes to obtain a transversality condition (see for example Obstfeld and Rogoff 1996). Here, the presence of the borrowing limit (3) makes the no-Ponzi condition redundant. We elaborate further on this point in footnote 28.

[14] We make this assumption, following the literature on technology diffusion, to generate asymmetries in productivity across the two regions. In the case of a single large developing country, this is equivalent to assuming that intermediate goods are nontradables. If several developing countries are present, instead, we are effectively assuming that intermediate inputs can be perfectly traded among developing countries. This assumption simplifies the exposition, but our results would hold also if trade of intermediate goods across developing countries was not possible.

where $0 < \alpha < 1$, and $A^j_{i,t}$ is the productivity, or quality, of input j.[15]

Profit maximization implies the demand functions

$$(9) \qquad (1-\alpha)\left(L^T_{i,t}\right)^{-\alpha}\int_0^1\left(A^j_{i,t}\right)^{1-\alpha}\left(x^j_{i,t}\right)^{\alpha}dj = W_{i,t}$$

$$(10) \qquad \alpha\left(L^T_{i,t}\right)^{1-\alpha}\left(A^j_{i,t}\right)^{1-\alpha}\left(x^j_{i,t}\right)^{\alpha-1} = P^j_{i,t},$$

where $P^j_{i,t}$ is the price in terms of the tradable good of intermediate input j. Due to perfect competition, firms producing the tradable good do not make any profit in equilibrium.

D. *Intermediate Goods Production and Profits*

Every intermediate good is produced by a single monopolist. One unit of tradable output is needed to manufacture one unit of the intermediate good, regardless of quality. In order to maximize profits, each monopolist sets the price of its good according to

$$(11) \qquad P^j_{i,t} = \frac{1}{\alpha} > 1.$$

This expression implies that each monopolist charges a constant markup $1/\alpha$ over its marginal cost.

Equations (10) and (11) imply that the quantity produced of a generic intermediate good j is

$$(12) \qquad x^j_{i,t} = \alpha^{\frac{2}{1-\alpha}}A^j_{i,t}L^T_{i,t}.$$

Combining equations (8) and (12) gives

$$(13) \qquad Y^T_{i,t} = \alpha^{\frac{2\alpha}{1-\alpha}}A_{i,t}L^T_{i,t},$$

where $A_{i,t} \equiv \int_0^1 A^j_{i,t}dj$ is an index of average productivity of the intermediate inputs. Hence, production of the tradable good is increasing in the average productivity of intermediate goods and in the amount of labor employed in the tradable sector. Moreover, the profits earned by the monopolist in sector j are given by

$$P^j_{i,t}x^j_{i,t} - x^j_{i,t} = \varpi A^j_{i,t}L^T_{i,t},$$

where $\varpi \equiv (1/\alpha - 1)\alpha^{2/(1-\alpha)}$. According to this expression, the profits earned by a monopolist are increasing in the productivity of its intermediate input and in employment in the tradable sector. The dependence of profits on employment is due to a market size effect. Intuitively, high employment in the tradable sector is associated

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[15] More precisely, for every good j, $A^j_{i,t}$ represents the highest quality available. In principle, firms could produce using a lower quality of good j. However, as in Aghion and Howitt (1992), the structure of the economy is such that in equilibrium only the highest quality version of each good is used in production.

with high production of the tradable good and high demand for intermediate inputs, leading to high profits in the intermediate sector.

E. *Innovation in the United States*

In the United States, firms operating in the intermediate sector can invest in innovation in order to improve the quality of their products. In particular, a US firm that employs in innovation $L^j_{u,t}$ units of labor sees its productivity evolve according to[16]

$$A^j_{u,t+1} = A^j_{u,t} + \chi A_{u,t} L^j_{u,t}, \tag{14}$$

where $\chi > 0$ determines the productivity of research. This expression embeds the assumption, often present in the endogenous growth literature, that innovators build on the existing stock of knowledge $A_{u,t}$. This assumption captures an environment in which existing knowledge is nonexcludable, so that inventors cannot prevent others from drawing on their ideas to innovate.[17]

Defining firms' profits net of expenditure in research as $\Pi^j_{u,t} \equiv \varpi A^j_{u,t} L^T_{u,t} - W_{u,t} L^j_{u,t}$, firms producing intermediate goods choose investment in innovation to maximize their discounted stream of profits

$$\sum_{t=0}^{\infty} \frac{\beta^t C^T_{u,0}}{C^T_{u,t}} \Pi^j_{u,t},$$

subject to (14). Since firms are fully owned by domestic households, they discount profits using the households' discount factor $\beta^t C^T_{u,0}/C^T_{u,t}$.

From now on, we assume that firms are symmetric and so $A^j_{u,t} = A_{u,t}$. Moreover, we focus on equilibria in which investment in innovation by US firms is always positive. Optimal investment in research then requires

$$\frac{W_{u,t}}{\chi A_{u,t}} = \frac{\beta C^T_{u,t}}{C^T_{u,t+1}} \left(\varpi L^T_{u,t+1} + \frac{W_{u,t+1}}{\chi A_{u,t+1}} \right). \tag{15}$$

Intuitively, firms equalize the marginal cost from performing research $W_{u,t}/(\chi A_{u,t})$ to its marginal benefit discounted using the households' discount factor. The marginal benefit is given by the increase in next period profits $(\varpi L^T_{u,t+1})$ plus the savings on future research costs $(W_{u,t+1}/(\chi A_{u,t+1}))$.

As it will become clear later on, a crucial aspect of the model is that the return from innovation is increasing in the size of the US tradable sector, as captured by $L^T_{u,t+1}$. This happens because higher economic activity in the tradable sector boosts the profits that firms producing intermediate goods enjoy from improving the quality of their products.[18] In this sense, the tradable sector is the engine of growth in our model.

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[16] In online Appendix C we demonstrate that our results are robust toward assuming that investment in innovation is done in terms of the tradable final good (a lab equipment model) rather than in terms of labor.

[17] This assumption, however, is not crucial for our results. We explore the case of partially excludable knowledge in Section IIIC.

[18] Alternatively, as in Krugman (1987), we could have assumed that productivity growth is increasing in the size of the tradable sector because of the presence of learning by doing effects. The key insights of the model would apply also to this case.

This feature of the framework aligns well with a few empirical observations. First, it is well documented that tradable sectors are typically characterized by higher productivity growth compared to sectors producing nontradable goods (Duarte and Restuccia 2010; Hlatshwayo and Spence 2014). Tradable sectors also play a key role in innovation activities. For instance, the manufacturing sector accounts for about 70 percent of total R&D spending done by US firms, in spite of representing only around 10 percent of value added.[19] Finally, the US productivity growth slowdown has hit particularly harshly the manufacturing sector (Syverson 2016). These facts suggest that one should place particular attention on manufacturing, and so on sectors producing tradable goods, to understand the decline in US productivity growth.

F. *Technology Adoption by Developing Countries*

In developing countries, firms producing intermediate goods improve the quality of their products by adopting technological advances originating from the United States.[20] Following the literature on international technology diffusion (Barro and Sala-i-Martin 1997), we formalize this notion by assuming that firms in developing countries draw on the US stock of knowledge when performing research. Productivity of a generic intermediate input j thus evolves according to

$$A_{d,t+1}^{j} = A_{d,t}^{j} + \xi A_{u,t}^{\phi} A_{d,t}^{1-\phi} L_{d,t}^{j}, \tag{16}$$

where $\xi > 0$ captures the productivity of research in developing countries, and $0 < \phi \leq 1$ determines the extent to which developing countries' firms benefit from the US stock of knowledge. Since we think of the United States as the technological leader and developing countries as the followers, we will focus on scenarios in which $A_{u,t} > A_{d,t}$ for all t.[21]

Firms producing intermediate goods in developing countries choose investment in research to maximize their stream of profits, net of research costs, subject to (16). We restrict attention to equilibria in which firms in developing countries are symmetric $\left(A_{d,t}^{j} = A_{d,t}\right)$, and their investment in technology adoption is always positive. Optimal investment in research then requires

$$\frac{W_{d,t}}{\xi A_{u,t}^{\phi} A_{d,t}^{1-\phi}} = \frac{\beta C_{d,t}^{T}}{C_{d,t+1}^{T}} \left(\varpi L_{d,t+1}^{T} + \frac{W_{d,t+1}}{\xi A_{u,t+1}^{\phi} A_{d,t+1}^{1-\phi}} \right). \tag{17}$$

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[19] This statistic refers to the OECD data series on "Business enterprise R&D expenditure by industry," for the period 2009–2017.

[20] This assumption captures the idea that, due to institutional features, the United States enjoys a strong comparative advantage in conducting innovation activities compared to developing countries. In fact, available empirical evidence on international patents citations suggests that the United States is a major knowledge exporter, while developing countries tend to import knowledge from abroad (Liu and Ma 2021). In online Appendix E we study a version of the model in which innovation may take place in developing countries too.

[21] In online Appendix E we consider an alternative scenario, in which developing countries technologically leapfrog the United States in the long run.

As it was the case for the United States, optimal investment in research equates the marginal cost from investing to its marginal benefit.[22] The difference is that for developing countries the marginal cost of performing research is decreasing in their distance from the technological frontier, as captured by the term $A_{u,t}/A_{d,t}$. This force pushes toward convergence in productivity between the two regions. Moreover, as it was the case for the United States, the benefit from investing in research is increasing in the size of the tradable sector $(L^T_{d,t+1})$. Also in developing countries, therefore, the tradable sector is the source of productivity growth, because this is where knowledge spillovers from the technological frontier concentrate. This feature is consistent with the empirical evidence provided by Rodrik (2012), who shows that cross-country convergence in productivity is restricted to the manufacturing sector.[23]

G. *Aggregation and Market Clearing*

Value added in the tradable sector is equal to total production of tradable goods net of the amount spent in producing intermediate goods. Using equations (12) and (13) we can write value added in the tradable sector as

$$Y^T_{i,t} - \int_0^1 x^j_{i,t}\,dj = \Psi A_{i,t} L^T_{i,t}, \tag{18}$$

where $\Psi \equiv \alpha^{2\alpha/(1-\alpha)}\left(1 - \alpha^2\right)$.

Market clearing for the nontradable good requires that in every region consumption is equal to production, so that

$$C^N_{i,t} = Y^N_{i,t} = L^N_{i,t}. \tag{19}$$

The market clearing condition for the tradable good can be instead written as

$$C^T_{i,t} + \frac{B_{i,t+1}}{R_{i,t}} = \Psi A_{i,t} L^T_{i,t} + B_{i,t}. \tag{20}$$

To derive this expression, we have used the facts that domestic households receive all the income from production, and that governments run balanced budgets every period. Moreover, global asset market clearing requires that

$$B_{u,t} = -B_{d,t}. \tag{21}$$

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[22] Notice that we are assuming that profits are discounted at rate $\beta^t C^T_{d,0}/C^T_{d,t}$. This corresponds to a case in which the subsidy on savings τ is restricted to investment in bonds only. Alternatively, we could have assumed that the subsidy on savings applies also to investment in research. Our main insights would also apply to this alternative setting. The only wrinkle is that then we would have to assume, as in Benigno and Fornaro (2018), that every firm has a constant probability of losing its stream of monopoly profits (perhaps because its technology is copied by another firm, or for some other shock that leads to the firm's death). This would be needed to maintain firms' value finite, even in environments in which the interest rate is persistently higher than the growth rate of the economy.

[23] More broadly, several empirical studies point toward the importance of trade in facilitating technology transmission from advanced to developing countries. Just to cite a few examples, Coe, Helpman, Hoffmaister (1997); Keller (2004); and Amiti and Konings (2007) highlight the importance of imports as a source of knowledge transmission, while Blalock and Gertler (2004); Park et al. (2010); and Bustos (2011) provide evidence in favor of exports as a source of productivity growth.

Finally, in every region the labor market must clear

$$\bar{L} = L_{i,t}^N + L_{i,t}^T + L_{i,t}^R. \tag{22}$$

In this expression, we have defined $L_{i,t}^R = \int_0^1 L_{i,t}^j dj$ as the total amount of labor devoted to research in region i.

H. *Equilibrium*

In the balanced growth path of the economy some variables remain constant, while others grow at the same rate as $A_{u,t}$.[24] In order to write down the equilibrium in stationary form, we normalize this second group of variables by $A_{u,t}$. To streamline notation, for a generic variable $X_{i,t}$ we define $x_{i,t} \equiv X_{i,t}/A_{u,t}$. We also denote the growth rate of the technological frontier as $g_t \equiv A_{u,t}/A_{u,t-1}$, and the proximity of a region to the frontier by $a_{i,t} \equiv A_{i,t}/A_{u,t}$ (of course, $a_{u,t} = 1$).

The model can be narrowed down to three sets of equations or "blocks." The first block describes the path of tradable consumption and capital flows. Using the notation spelled out above, the households' Euler equation becomes

$$\frac{\omega}{c_{i,t}^T} = R_{i,t}(1 + \tau_{i,t})\left(\frac{\beta\omega}{g_{t+1} c_{i,t+1}^T} + \tilde{\mu}_{i,t}\right), \tag{23}$$

where $\tilde{\mu}_{i,t} \equiv A_{u,t}\mu_{i,t}$. To ensure the existence of a balanced growth path, we assume that the borrowing limit of each region is proportional to productivity ($\kappa_{i,t} = \kappa_t A_{i,t+1} > 0$), where κ_t is a time-varying parameter with steady state value $\kappa > 0$. Condition (5) can thus be written as

$$b_{i,t+1} \geq -\kappa_t a_{i,t+1} \quad \text{with equality if} \quad \tilde{\mu}_{i,t} > 0. \tag{24}$$

Moreover, the optimality condition for asymptotic bond holdings (6) becomes

$$\lim_{k\to\infty} \frac{b_{i,t+1+k} g_{t+1} \cdots g_{t+1+k}}{R_{i,t}(1 + \tau_{i,t}) \ldots R_{i,t+k}(1 + \tau_{i,t+k})} \leq 0. \tag{25}$$

Finally, the market clearing conditions for the tradable good and for bonds become

$$c_{i,t}^T + \frac{g_{t+1} b_{i,t+1}}{R_{i,t}} = \Psi a_{i,t} L_{i,t}^T + b_{i,t} \tag{26}$$

$$b_{u,t} = -b_{d,t}. \tag{27}$$

These equations define the path of $c_{i,t}^T$, $b_{i,t}$ and $R_{i,t}$ given a path for productivity and tradable output. In a financially integrated world, these equations determine the behavior of capital flows across the two regions.

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[24] Our baseline model abstracts from the forces linked to structural transformation, meaning that the sectoral employment shares are constant along the balanced growth path. Therefore, some of the variables in our model can be interpreted as the deviation of their actual value from the structural transformation path. We introduce explicitly structural change in online Appendix G.

The second block of the model describes how productivity evolves. Throughout, we will focus on interior equilibria in which $L_{i,t}^N > 0$ for every i and t. In this case, as it is easy to verify, $W_{i,t} = (1-\alpha)\alpha^{2\alpha/(1-\alpha)}A_{i,t}$. In equilibrium, equation (15) then becomes

$$g_{t+1} = \frac{\beta c_{u,t}^T}{c_{u,t+1}^T}\left(\chi\alpha L_{u,t+1}^T + 1\right). \tag{28}$$

This equation captures the optimal investment in research by US firms, and implies a positive relationship between productivity growth and expected future employment in the tradable sector. Intuitively, a rise in production of tradable goods is associated with higher monopoly profits. In turn, higher expected profits induce entrepreneurs to invest more in research, leading to a positive impact on the growth rate of productivity.[25] This is the classic market size effect emphasized by the endogenous growth literature, with a twist. The twist is that the allocation of labor across the two sectors matters for productivity growth.[26] Moreover, productivity growth is decreasing in the growth rate of normalized tradable consumption, $c_{u,t+1}^T/c_{u,t}^T$. A rise in expected consumption growth, the reason is, leads households to discount more heavily future dividends, which translates into a fall in firms' investment.

Following similar steps, we can use (17) to obtain an expression describing the evolution of productivity in developing countries

$$a_{d,t}^{\phi} = \frac{\beta c_{d,t}^T}{g_{t+1}c_{d,t+1}^T}\left(\xi\alpha L_{d,t+1}^T + a_{d,t+1}^{\phi}\right). \tag{29}$$

This equation describes how the proximity of developing countries to the technological frontier evolves in response to firms' investment in research. As in the United States, a larger tradable sector induces more investment in research by developing countries and thus leads to a closer proximity to the frontier.

The last block describes the use of productive resources, that is how labor is allocated across the production of the two consumption goods and research. To derive an expression for $L_{i,t}^N$, we can use $Y_{i,t}^N = L_{i,t}^N$ and $W_{i,t} = P_{i,t}^N$ to write equation (7) as

$$L_{i,t}^N = \frac{1-\omega}{\omega(1-\alpha)\alpha^{\frac{2\alpha}{1-\alpha}}}\frac{c_{i,t}^T}{a_{i,t}} \equiv \Gamma\frac{c_{i,t}^T}{a_{i,t}}. \tag{30}$$

The interesting aspect of this equation is that production of nontradable goods is positively related to consumption of tradables, because of households' desire to balance their consumption across the two goods. Hence, as tradable consumption rises

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[25] To be more precise, higher growth reduces households' desire to save, leading to an increase in the cost of funds for firms investing in research. In fact, in the new equilibrium the rise in growth and in the cost of funds are exactly enough to offset the impact of the rise in expected profits on the return from investing in research.

[26] To clarify, what matters for our main results is that productivity growth is increasing in the share of labor allocated to the tradable sector. This means that our key results would also apply to a setting in which scale effects related to population size were not present. For instance, in the spirit of Young (1998) and Howitt (1999), these scale effects could be removed by assuming that the number of intermediate inputs available inside a country is proportional to population size.

more labor is allocated to the nontradable sector. As we will see, this effect plays a key role in mediating the impact of capital flows on productivity growth.

Expressions for $L_{i,t}^R$ can be derived by writing equations (14) and (16) as

$$\begin{aligned} L_{u,t}^R &= \frac{g_{t+1} - 1}{\chi} \\ L_{d,t}^R &= \frac{g_{t+1} a_{d,t+1} - a_{d,t}}{\xi a_{d,t}^{1-\phi}}. \end{aligned}$$

As it is intuitive, faster productivity growth or a closer proximity to the frontier requires larger innovation effort, and hence more labor allocated to research.

Plugging these expressions in the market clearing condition for labor then gives

$$L_{u,t}^T = \bar{L} - \Gamma c_{u,t}^T - \frac{g_{t+1} - 1}{\chi} \tag{31}$$

$$L_{d,t}^T = \bar{L} - \Gamma \frac{c_{d,t}^T}{a_{d,t}} - \frac{g_{t+1} a_{d,t+1} - a_{d,t}}{\xi a_{d,t}^{1-\phi}}. \tag{32}$$

These equations can be interpreted as the resource constraints of the economy.

We collect these observations in the following lemma.

LEMMA 1: *In equilibrium the paths of real allocations* $\{c_{i,t}^T, b_{i,t+1}, \tilde{\mu}_{i,t}, a_{i,t+1}, L_{i,t}^T\}_{i,t}$, *interest rates* $\{R_{i,t}\}_{i,t}$ *and growth rate of the technological frontier* $\{g_{t+1}\}_t$, *satisfy* (23), (24), (25), (26), (27), (28), (29), (31), *and* (32) *given a path for the borrowing limit* $\{\kappa_t\}_t$ *and initial conditions* $\{b_{i,0}, a_{i,0}\}_i$.

II. Financial Integration and Global Productivity Growth

In this section we study the impact of financial integration on global productivity growth. We start by characterizing the balanced growth path—or steady state—of the model. Focusing on steady states, and thus on the long-run behavior of the economy, allows us to derive analytically our key results about the impact of financial integration on global productivity growth. Thereafter, we consider transitional—or medium-run—dynamics.

Steady state equilibria can be represented using two simple diagrams. The first diagram connects global productivity growth to the size of the tradable sector in the United States. Start by considering that in steady state $c_{i,t}^T$, $L_{i,t}^T$, and g_{t+1} are all constant. We can then write equation (28) as

$$g = \beta(\chi \alpha L_u^T + 1), \tag{GG_u}$$

where the absence of a time subscript denotes the steady state value of a variable. The GG_u schedule captures the incentives to innovate for US firms. Due to the market size effect described above, optimal investment in innovation in the United States gives rise to a positive relationship between g and L_u^T. A second relationship between g and L_u^T can be obtained by writing equation (31) as

$$L_u^T = \bar{L} - \Gamma c_u^T - \frac{g - 1}{\chi}. \tag{RR_u}$$

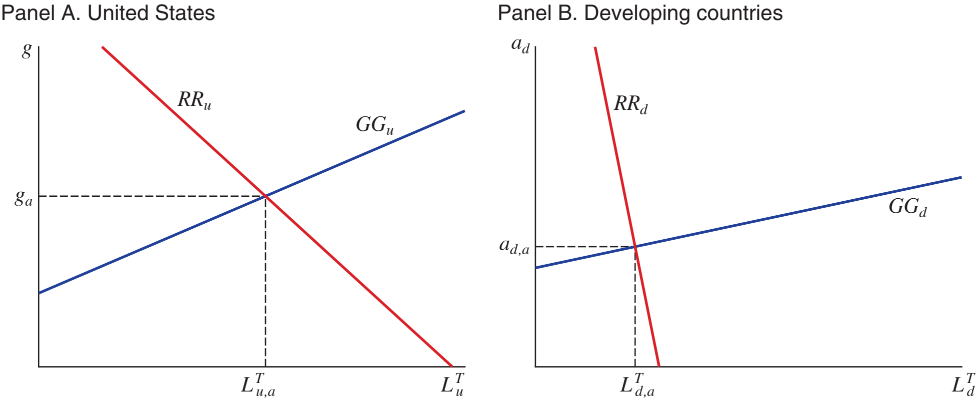

Figure 2. Steady State Equilibria

The RR_u schedule captures the resource constraint of the US economy. Faster productivity growth requires more research effort, leaving less labor to be allocated to production. This explains why the RR_u schedule describes a negative relationship between g and L^T_u. Together, these two schedules determine the equilibrium in the United States for a given value of c^T_u (Figure 2, panel A).

A similar approach can be used to describe the equilibrium in developing countries. Recall that we are focusing on equilibria in which investment in research by developing countries is always positive. This implies that in steady state productivity in developing countries grows at rate g, and so their proximity to the technological frontier is constant. Hence, in steady state (29) reduces to

$$(GG_d) \qquad a_d^{\phi} = \frac{\beta \xi \alpha L^T_d}{g - \beta}.$$

The GG_d schedule captures the incentives of firms in developing countries to adopt technologies from the frontier. As production of tradables by developing countries increases, the return to increasing productivity rises, leading to higher investment in research and a closer proximity to the frontier. Instead, the steady state counterpart of (32) is

$$(RR_d) \qquad L^T_d = \bar{L} - \Gamma \frac{c^T_d}{a_d} - \frac{(g - 1) a_d^{\phi}}{\xi}.$$

Intuitively, maintaining a closer proximity to the frontier requires more research labor, leaving less labor to production of tradable goods. This explains the negative relationship between a_d and L^T_d implied by the RR_d schedule, for a given value of c^T_d/a_d. The intersection of these two schedules determines the equilibrium value of a_d and L^T_d (Figure 2, panel B)—again holding constant c^T_d/a_d. To fully characterize the equilibrium we need to specify a financial regime. We turn to this task next.

A. *Financial Autarky*

Under financial autarky, financial flows across the two regions are not allowed. Since households inside every region are symmetric, it must then be that $b_{u,t} = b_{d,t} = 0$. We can thus define an equilibrium under financial autarky as follows.

DEFINITION 1: *An equilibrium under financial autarky satisfies the conditions stated in Lemma 1 and* $b_{i,t} = 0$ *for all i and t.*

In each region consumption of tradable goods must be equal to output, and so $c_{i,t}^{T} = a_{i,t}\Psi L_{i,t}^{T}$. It is then a matter of simple algebra to solve for the steady state values of g and a_d. Combining the GG_u and RR_u equations one gets that

$$g_a = \beta\left(\frac{\alpha\left(\chi\bar{L} + 1 - \beta\right)}{1 + \Gamma\Psi + \alpha\beta} + 1\right), \tag{33}$$

where the subscript a denotes the value of a variable under financial autarky. According to this expression, a higher productivity of research in the United States (i.e., a higher χ) leads to faster growth in the world technological frontier. Moreover, as the tradable sector share of value added rises (i.e., as ω increases, and so Γ falls), more resources are devoted to innovation leading to faster productivity growth.

To solve for the equilibrium in developing countries we can combine equations GG_d and RR_d to obtain

$$a_{d,a}^{\phi} = \frac{\alpha\beta\xi\bar{L}}{\left(g_a - \beta\right)\left(1 + \Gamma\Psi\right) + \left(g_a - 1\right)\alpha\beta}. \tag{34}$$

Naturally, a higher ξ is associated with a more efficient process of technology adoption in developing countries, and thus to a closer proximity to the frontier in steady state.[27] Moreover, a larger size of the tradable sector (i.e., a lower Γ) is associated with a closer proximity to the frontier, because technology adoption is the result of research efforts by firms in the tradable sector.

Finally, under financial autarky the two regions feature different interest rates. Recalling that $\tau_{u,t} = 0$, using US households' Euler equation gives

$$R_{u,a} = \frac{g_a}{\beta}.$$

Instead, since $\tau_{d,t} = \tau > 0$, the households' Euler equation in developing countries implies that

$$R_{d,a} = \frac{g_a}{\beta(1 + \tau)} < R_{u,a}.$$

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[27] $a_{d,a}$, instead, is decreasing with the growth rate of the technological frontier g_a. This happens because a faster pace of innovation in the United States requires more resources devoted to research by developing countries in order to maintain a constant proximity to the frontier.

Hence, in the long run developing countries feature a lower interest rate compared to the United States. This is just the outcome of the higher propensity to save characterizing households in developing countries compared to that of the United States.

PROPOSITION 1: *Suppose that*

$$(i)\quad \beta\left(\frac{\alpha\left(\chi\bar{L} + 1 - \beta\right)}{1 + \Gamma\Psi + \alpha\beta} + 1\right) > 1 \quad \textit{and} \quad (ii)\quad \xi < \chi. \tag{35}$$

Then under financial autarky there is a unique steady state in which productivity in both regions grows at rate $g_a > 1$, *given by* (33), *and developing countries' proximity to the frontier is equal to* $a_{d,a} < 1$, *given by* (34). *Moreover,* $R_{u,a} = g_a/\beta$ *and* $R_{d,a} = g_a/\left[(1 + \tau)\beta\right] < R_{u,a}$.

Proposition 1 summarizes the results derived so far. The role of condition (35) is to guarantee that in steady state productivity grows at a positive rate $(g_a > 1)$, and that developing countries do not catch up fully with the technological frontier $(a_{d,a} < 1)$. This second condition is satisfied if the ability of developing countries to adopt US technologies is sufficiently small compared to the productivity of research in the United States.

B. *Financial Integration*

What is the impact of financial globalization on growth? To answer this question, we now turn to a scenario in which the two regions are financially integrated. Since capital flows freely across the two regions, interest rates must be equalized and so $R_{u,t} = R_{d,t}$. We are now ready to define an equilibrium under financial integration.

DEFINITION 2: *An equilibrium under financial integration satisfies the conditions stated in Lemma 1 and* $R_{u,t} = R_{d,t}$ *for all t.*

Recall that households in developing countries have a higher propensity to save compared to that of the United States. In the long-run US households thus borrow up to their limit and $b_{u,f} = -\kappa$, where the subscript f denotes the value of a variable in the steady state with financial integration. Conversely, households in developing countries have positive assets in the long run. Their Euler equation thus implies that in steady state

$$R_f = \frac{g_f}{\beta(1 + \tau)}, \tag{36}$$

where R_f denotes the steady state world interest rate under financial integration. We can then use equation (26) to write

$$c^T_{u,f} = \Psi L^T_{u,f} + \kappa\left(\frac{g_f}{R_f} - 1\right) = \Psi L^T_{u,f} + \kappa\left[\beta(1 + \tau) - 1\right]. \tag{37}$$

This equation highlights how the US trade balance in steady state $(\Psi L_{u,f}^{T} - c_{u,f}^{T})$ crucially depends on the ratio g_f / R_f, which is in turn determined by $\beta(1+\tau)$.

In what follows, we will focus on the case $g_f > R_f$ by assuming that $\beta(1+\tau) > 1$.[28] Empirically, at least if one interprets R_f as the return on US government bonds, this condition is in line with the experience of the United States since the mid-1990s. Moreover, under this assumption, in steady state the US trade balance is in deficit. This feature of the model is consistent with the fact that the United States has been running persistent trade deficits over the last 30 years (Figure 1) without significantly raising its external-debt-to-GDP position.[29] To be clear, our main insights do not rely on this assumption. In online Appendix D, we consider an economy in which $g_f < R_f$, and we show that in this case a global financial resource curse can arise during the transition toward the final steady state.

Perhaps the best way to understand the impact of financial integration on productivity growth is to employ the diagrams presented in Figure 3. Let us start from the United States. In a financially integrated world, since $\beta(1+\tau) > 1$, the United States ends up running trade deficits in the long run. In turn, trade deficits sustain consumption of tradable goods, which rises above production $(c_{u,f}^{T} > \Psi L_{u,f}^{T})$. Higher consumption of tradable goods pushes up demand for nontradables. In order to satisfy this increase in demand, labor migrates from the tradable sector toward the nontradable one, and so L_u^T falls. Graphically, this is captured by the leftward shift of the RR_u curve. This is not, however, the end of the story. As the tradable sector shrinks, firms' incentives to innovate fall—because the profits appropriated by successful innovators are now smaller.[30] The result is a drop in productivity growth in the United States.[31] Therefore, paradoxically, cheap

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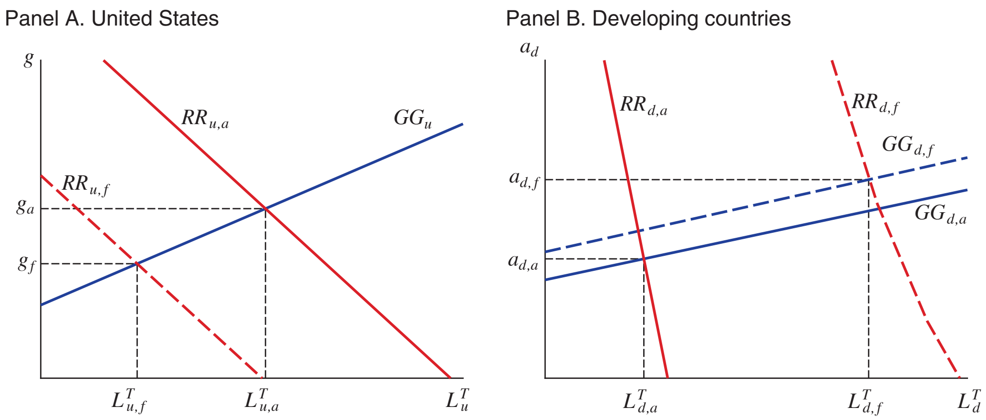
[28] As is well known, studying economies in which the interest rate is lower than the growth rate of output might be tricky, since the present value of the economy's resources might be unbounded (see the discussion on page 65 of Obstfeld and Rogoff (1996). Luckily, our model can accommodate this case. Let us start by considering households in developing countries. The interest rate faced by these households is $R_f(1+\tau)$, which, by equation (36), is larger than g_f. Hence, from the point of view of households in developing countries, the present value of income is finite and the terminal condition (25) is satisfied with equality. Things are a bit more complicated for households in the United States. Since they face an interest rate lower than the growth rate of output, the present value of their expected income is infinite. Still, the utility enjoyed by US households is finite, since the borrowing limit (3) prevents them from fully frontloading the consumption of their expected stream of future income. What about the no-Ponzi condition usually imposed by lenders? Notice that here the lenders are households in developing countries, which receive an interest rate equal to $R_f(1+\tau)$. Moreover, consider that, due to the borrowing limit (3), in steady state US households' liabilities cannot grow at a rate larger than g_f. It follows that, since $R_f(1+\tau) > g_f$, the borrowing limit (3) is more stringent than the conventional constraint imposed by lenders to rule out Ponzi schemes.

[29] As documented by Mehrotra and Sergeyev (2021), the rate of return on US government bonds has been lower than the growth rate of the US economy for most of the post-WWII period.

[30] For completeness, let us mention that the model embeds a second effect that could lead to a positive relationship between capital inflows into the United States and investment in innovation by US firms. Indeed, capital inflows lead to a reduction in the cost of funds for US firms, and so to a fall in the cost of investing in innovation. Hence, the model is consistent with the empirical finding by Varela (2018), who documents that capital inflows foster investment in innovation by credit-constrained firms, relative to unconstrained ones. In steady state, however, it turns out that this cost of funds effect is always dominated by the profit effect described in the main text. We further elaborate on this point in Section IIC.

[31] Besides lower innovation in the tradable sector, there is also a composition effect depressing productivity growth in the United States. Since productivity growth is lower in the nontradable sector, the shift of factors of production from the tradable to the nontradable sector mechanically lowers productivity growth. To streamline the exposition, in this section we focus on the—less mechanical and arguably more interesting—behavior of productivity in the tradable sector. Empirically, the productivity growth slowdown in the United States has been characterized by a sharp fall in productivity growth in manufacturing (Syverson 2016). We will elaborate further on the composition effect in Section IIIC.



Panel A. United States

Panel B. Developing countries

Figure 3. Impact of Financial Integration

access to capital inflows depresses investment and productivity growth, because these inflows end up financing a boom in the nontradable sector.

All these results can be derived analytically, by combining the GG_u and RR_u equations with (37) to obtain

$$g_f = g_a - \frac{\alpha\beta\chi\Gamma}{1 + \Gamma\Psi + \alpha\beta}\kappa\left[\beta(1 + \tau) - 1\right]. \tag{38}$$

Because we assume $\beta(1 + \tau) > 1$, this expression shows that financial integration depresses g below its value under financial autarky. Moreover, this effect is stronger the larger the capital inflows toward the United States, here captured by a higher value of the parameter κ.

In some respects, the impact of financial integration on developing countries is the mirror image to that of the United States. In developing countries, tradable consumption is given by

$$c^T_{d,f} = \Psi a_{d,f} L^T_{d,f} - \kappa\left[\beta(1 + \tau) - 1\right]. \tag{39}$$

Naturally, to finance trade surpluses consumption of tradables has to fall below production $(c^T_{d,f} < \Psi a_{d,f} L^T_{d,f})$.[32] This causes a drop in demand for nontradable goods, which induces labor to shift out of the nontradable sector toward the tradable one. Graphically, this effect corresponds to a rightward shift of the RR_d curve.[33] As the tradable sector grows larger, firms in developing countries increase their spending in research. They do so in order to appropriate the now higher profits derived from upgrading their productivity. As illustrated by Figure 3, panel B, this process pushes developing countries closer to the technological frontier.

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[32] We restrict the analysis to values of κ small enough so that tradable consumption in developing countries is always positive.

[33] The shift in the GG_d curve, instead, is due to the impact of financial integration on US productivity growth.

More precisely, by combining the GG_d and RR_d equations with (39) one finds that

$$a_{d,f}^{\phi} = \frac{\alpha\beta\xi\left(\bar{L} + \Gamma\frac{\kappa[\beta(1+\tau)-1]}{a_{d,f}}\right)}{(g_f-\beta)(1+\Gamma\Psi) + (g_f-1)\alpha\beta}. \tag{40}$$

Comparing this expression with (34) shows that, since $\beta(1+\tau) > 1$ and $g_f < g_a$, financial integration increases developing countries' proximity to the frontier. Again, this effect is stronger the larger the capital flows out of developing countries, that is, the higher κ.

In spite of the increase in a_d, however, it is far from clear that financial integration generates long run productivity improvements in developing countries. The reason is that developing countries absorb technological advances originating from the United States. Therefore, lower innovation activities in the United States translate into a drop in the steady state rate of productivity growth in developing countries. Hence, at least in the long run, the process of financial integration generates a fall in global productivity growth.

PROPOSITION 2: *Suppose that* $\beta(1+\tau) > 1$ *and that*

$$(i) \quad \kappa[\beta(1+\tau)-1] < \frac{(g_a-1)(1+\Gamma\Psi+\alpha\beta)}{\alpha\beta\chi\Gamma} \tag{41}$$

and

$$(ii) \quad \kappa[\beta(1+\tau)-1] < \frac{\bar{L}(\chi-\xi)}{\Gamma(\chi+\xi)},$$

where g_a *is given by* (33). *Then under financial integration there is a unique steady state in which productivity in both regions grows at rate* g_f, *given by* (38), *satisfying* $1 < g_f < g_a$. *Developing countries' proximity to the frontier is equal to* $a_{d,f}$, *given by* (40), *with* $a_{d,a} < a_{d,f} < 1$. *Both regions share the same interest rate given by* $R_f = g_f/[(1+\tau)\beta]$.

Proposition 2 summarizes our observations about the impact of financial integration on productivity. As it was the case under financial autarky, the role of condition (41) is to guarantee that in steady state productivity grows at a positive rate ($g_f > 1$), and that developing countries do not catch up fully with the technological frontier ($a_{d,f} < 1$). Because financial integration reduces g_f and raises $a_{d,f}$ relative to their values under financial autarky, this amounts to assuming that capital flows, captured by the variable $\kappa[\beta(1+\tau)-1]$, are not too large.

Our framework also gives a new perspective on the impact of financial integration on interest rates. In standard models, after two regions integrate financially, the equilibrium interest rate lies somewhere in between the two autarky rates. This is not the case here. In fact, it is easy to see that the interest rate under financial integration lies below both autarky rates ($R_f < R_{d,a} < R_{u,a}$). This happens because financial integration depresses the rate of global productivity growth. Lower productivity growth boosts households' supply of savings, and drives down the world interest rate below the values observed under financial autarky.

COROLLARY 1: *Suppose that* (41) *holds and that* $\beta(1 + \tau) > 1$. *Then the world interest rate under financial integration is lower than the two autarky rates* $(R_f < R_{d,a} < R_{u,a})$.

Several commentators have argued that the integration in the international financial markets of developing countries, by giving rise to a global saving glut, had a large negative impact on global interest rates (Bernanke 2005). In our model this effect is present, but it is magnified by the drop in global productivity growth associated with financial globalization. Hence, here the global saving glut leads to a regime of super low global interest rates, characterized by weak investment and low growth.

What about the return to investment? It turns out that financial globalization opens up a wedge between the interest rate on US bonds and the return to investment in innovation. To see this point, note that the return enjoyed by US firms on their investment is equal to

$$R^I_{u,t+1} \equiv \frac{\varpi L^T_{u,t+1} + W_{u,t+1}/(\chi A_{u,t+1})}{W_{u,t}/(\chi A_{u,t})}.$$

Using equation (15), it is easy to see that in steady state $R^I_u = g/\beta$. Therefore, under financial autarky, the return to investment in innovation is equal to the US interest rate ($R^I_{u,a} = g_a/\beta = R_{u,a}$). Following financial globalization, however, the return to investment ends up being higher than the world rate ($R^I_{u,f} = g_f/\beta > R_f$). This happens because, due to the presence of financial frictions, the high demand for bonds coming from developing countries translates into an only mild decline in the US return to investment. This feature of the model is consistent with the fact that, since the early 2000s, there has been a rise in the spread between the interest rate and the return to capital in the United States (Farhi and Gourio 2018).[34]

Before concluding this section, two remarks are in order. First, in our model inflows of foreign capital depress productivity growth in the recipient country because they reduce economic activity in the tradable sector. Due to its similarities with the notion of natural resource curse, in Benigno and Fornaro (2014) this effect has been dubbed the *financial resource curse*. Here, however, the implications are much more dramatic. In fact, one could naively think that countries experiencing capital outflows—and so an expansion of their tradable sector—would enjoy faster productivity growth. But, as we have just shown, this conclusion is not correct. In

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[34] The increase in the spread between bonds, which are associated with safety, and capital, whose return is instead inherently risky, has often being attributed to a rise in investors' risk aversion. It would be straightforward to capture these type of considerations in the model. We would just need to assume, as done for instance in Aghion and Howitt (1992), that investment in innovation is risky.

our model the slowdown in productivity growth affects capital-exporting countries too, giving rise to a *global financial resource curse*.

Second, a common view is that the United States' ability to attract foreign capital represents an exorbitant privilege, which benefits US citizens by allowing them to consume more than what they produce. Our model paints a more nuanced picture, in which the impact of capital inflows on welfare is a priori ambiguous. To see this point, consider that in steady state the lifetime utility of US households can be expressed as

$$\frac{1}{1-\beta}\left[\log\left(c_u^T\right)+\frac{\beta\omega}{1-\beta}\log(g)\right].$$

Holding productivity constant, capital inflows increase welfare by boosting c_u^T. This is the standard exorbitant privilege effect. But in our framework capital inflows also depress productivity growth g, which has a negative effect on welfare. As we will see in Section IIIC, the second effect may very well dominate the first one, and capital inflows may end up lowering welfare in the recipient country. In this case the exorbitant privilege morphs into an exorbitant burden.[35] How can a transfer of resources from abroad lower welfare? This paradoxical finding is due to the presence of inter-firms knowledge spillovers. Intuitively, knowledge spillovers depress the private return from innovating below the social one, causing private firms to underinvest in innovation compared to the social optimum (Aghion and Howitt 1992). Capital inflows may lower welfare because they exacerbate private firms' tendency to underinvest.

C. *Medium-Run Dynamics*

So far, we have focused our analysis on steady states, that is on the long run behavior of the economy. In this section, instead, we focus on the medium run, that is on the transition from a regime of financial autarky to financial integration. To anticipate our main finding, during the transition developing countries can experience an acceleration in productivity growth, as they push themselves closer to the technological frontier.[36] Therefore, when developing countries start joining the international credit markets, global productivity growth might accelerate. But this growth acceleration might only be temporary and, due to the logic of the global financial resource curse, global productivity growth might eventually slow down in the long run.

To make these points we resort to some simple numerical simulations. To be clear, our goal here is not to be quantitative, but to illustrate the forces at the heart of the model for some reasonable values of the parameters.[37] We perform the following experiment. The economy is in the financial autarky steady state in period $t = 0$. In period $t = 1$ international credit markets open up, and the economy transits toward

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[35] Pettis (2011) coined the term exorbitant burden, to describe the notion that the exorbitant privilege hurts US manufacturing.

[36] This is consistent with the experience of several developing countries, in which capital outflows were coupled with fast productivity growth (Gourinchas and Jeanne 2013).

[37] We defer a quantitative analysis to Section IIIC.

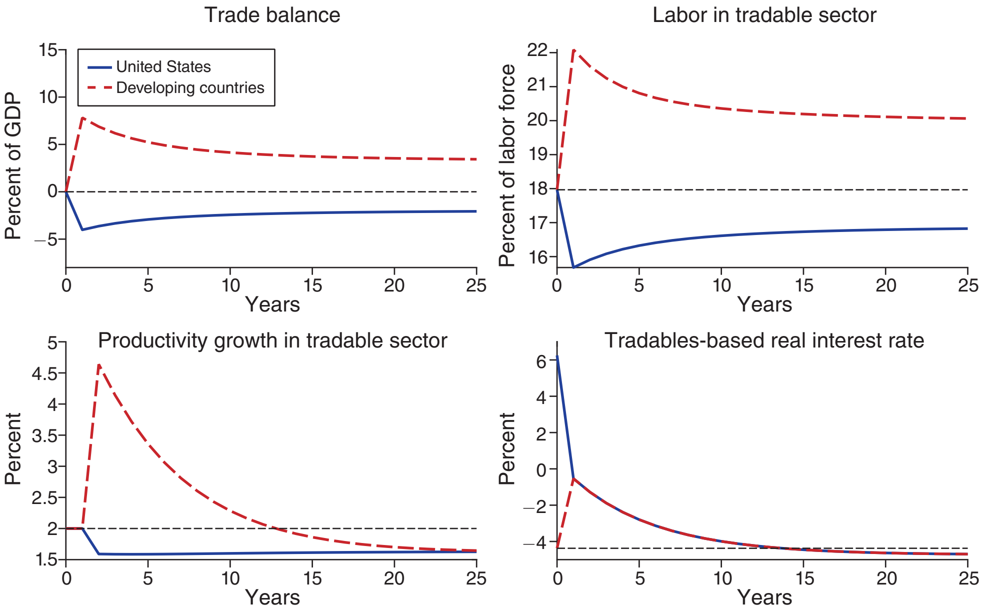

Figure 4. An Example of Transition from Autarky to Financial Integration Steady State

Notes: The process of financial integration is captured by a gradual rise in κ_t, which is governed by (42). Financial integration is not anticipated by agents in periods $t < 1$. From period $t = 1$ on agents have perfect foresight.

the steady state with financial integration. We model the opening of the international credit markets as a gradual increase in the borrowing limit κ_t, which follows the path

$$\kappa_t = \frac{1}{1+\rho}\kappa_{t-1} + \frac{\rho}{1+\rho}\kappa, \tag{42}$$

where $\kappa > 0$ continues to denote the steady state value of the borrowing limit, and $\kappa_0 = 0$.[38] The parameter ρ determines the speed with which restrictions on cross-border capital flows are lifted. We set $\rho = 0.15$ so that the transition lasts about 25 years. This assumption guarantees that the global economy experiences a protracted period of sizable current account imbalances, in line with the pattern of capital flows shown in Figure 1, panel A.

Figure 4 displays the economy's transitional dynamics, following the opening of international credit markets to developing countries.[39] The top-left panel shows

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[38] Financial integration is modeled as an unexpected shock, in the sense that in periods $t < 1$ agents expect the world to remain in financial autarky forever. From period $t = 1$ on agents have perfect foresight.

[39] To construct the figure, we target an initial growth rate in the United States of 2 percent, a share of R&D expenditure to GDP of 2.5 percent, a share of tradables in consumption of 25 percent, and a trade balance deficit in the financial integration steady state of 2 percent relative to GDP. In developing countries, we target an initial proximity to the frontier of 50 percent, and we set $\phi = 1$ for the degree of knowledge spillovers. Moreover, we normalize $\bar{L} = 1$. This yields the parameters $\beta = 0.96$, $\omega = 0.25$, $1 - \alpha = 0.53$, $\chi = 0.74$, $\xi = 0.32$, $\kappa = 0.045$, $\tau = 0.11$. As we noted before, this parameterization is purely illustrative and not meant to be quantitative. For instance, our simulations feature an excessively large drop in the US interest rate upon financial integration. This is due to the fact that in our model the United States earns the same return on its foreign assets and liabilities, and so to generate a sizable trade balance deficit in steady state an interest rate far below the growth rate of the economy is needed. In reality, the United States earns large excess returns on its foreign portfolio (Gourinchas and Rey 2007). It would be easy to introduce this feature in the model, which would reconcile persistent US trade balance deficits with a realistic drop in the interest rate.

that the process of financial integration is characterized by large capital flows out of developing countries and toward the United States. As a result, the United States experiences a persistent spell of sizable trade balance deficits, which result in a consumption boom. Moreover, the rise in US consumption induces a reallocation of labor in the United States toward the nontradable sector, at the expense of the tradable one (top-right panel). As economic activity in the tradable sector falls, US firms cut back their investment in innovation, resulting in a drop in productivity growth in the US tradable sector.[40] These dynamics are all in line with the steady state analysis discussed in Section II.

Turning to developing countries, financial integration is associated with large trade balance surpluses, and thus with an increase in economic activity in the tradable sector. Higher profits in the tradable sector lead firms in developing countries to increase their investment in technology adoption. Initially, this effect generates an acceleration in productivity growth in developing countries, which pushes them closer to the technological frontier. Hence, in the medium run, the model reproduces the positive correlation between productivity growth and capital outflows documented for developing countries by Gourinchas and Jeanne (2013). Eventually, however, productivity growth in developing countries slows down falling below the growth rate in the initial autarky steady state. The reason, of course, is that low productivity growth in the United States reduces the scope for technology adoption in developing countries. The model thus qualifies the view that developing countries can boost technology adoption and productivity growth by running trade balance surpluses, that is the Bretton Woods II view popularized by Dooley, Folkerts-Landau, and Garber (2004). We will go back to this point in Section IVB.

The bottom-right panel of Figure 4 shows the path of interest rates, measured in units of the tradable good. Financial globalization leads to interest rate equalization between the United States and developing countries. As standard frameworks would predict, on impact the world interest rate lies between the two autarky rates. This means that the United States experiences a fall in its interest rate, while the interest rate in developing countries increases above its autarky value. This situation, however, is only temporary. As global growth slows down the world interest rate keeps falling. After a few years since the start of financial globalization, in fact, the world interest rate falls below both autarky rates. Therefore, in the long run the world enters a state of superlow interest rates, in which both the United States and developing countries experience a drop in their interest rate below the autarky values.[41]

To close this section, let us spend a few words on the behavior of US productivity during the transition. Under our baseline parametrization, financial integration is associated with an immediate drop in US productivity growth. However, one can design examples in which productivity growth in the United States rises at the start of the transition, and then gradually declines below its value in the initial steady

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[40] Productivity growth drops with a lag relative to the emergence of trade deficits in the simulation, because it takes time for investment in innovation to affect productivity. In their empirical analysis, Aghion et al. (2024) find that the effect of investments in innovation on productivity materializes after 2 to 5 years.

[41] Similar to what happens in steady state, the return to investment in innovation in the United States instead experiences only a mild fall. It follows that along the transition triggered by financial globalization a positive spread between the return to investment in the United States and the world interest rate opens up.

state. To gain intuition, it is useful to go back to the equilibrium condition on the market for innovation (28)

$$g_{t+1} = \frac{\beta c_{u,t}^{T}}{c_{u,t+1}^{T}}\left(\chi\alpha L_{u,t+1}^{T} + 1\right).$$

According to this expression, there are two contrasting channels through which capital inflows influence firms' incentives to invest in innovation. As discussed above, by causing a drop in $L_{u,t+1}^{T}$ capital inflows depress profits in the tradable sector, and so the return to investment. But capital inflows also induce a consumption boom and a rise in $c_{u,t}^{T}/c_{u,t+1}^{T}$—or equivalently a drop in the rate at which US households discount future profits. Through this channel, capital inflows reduce US firms' cost of funds and increase firms' incentives to invest.

It turns out that the persistence of capital inflows is the key determinant of which effect prevails. To see why, notice that the profit effect depends on future capital flows, since investment decisions are based on future expected profits. The cost of funds effect, instead, is determined by current capital flows, since firms' cost of investment depends on current consumption. The profit effect, therefore, tends to dominate when capital inflows are persistent—as it has been the case for the United States since the late 1990s.[42] The cost of funds effect, instead, tends to dominate when movements in capital flows are abrupt and short-lived. For instance, our model would predict US productivity growth to fall during a sudden stop in capital inflows toward the United States.

III. Suggestive Evidence and Quantitative Implications

In contrast with conventional wisdom, in our theory capital inflows may be associated with productivity growth slowdowns. This effect is the result of two economic forces: (i) persistent capital inflows lead to lower economic activity in the tradable sector, (ii) lower economic activity in the tradable sector reduces productivity growth. Is there something about it in the data? We address this question by presenting some empirical evidence consistent with these implications of the model.[43] In doing so, we draw on a recent empirical literature studying the relationship between capital flows, sectoral allocation of productive resources and productivity. Our contribution here is mainly to reorganize this evidence in a consistent fashion, and to relate it to our theory.

A. *Cross-Sectional Evidence*

In a seminal paper, Gourinchas and Jeanne (2013) use a cross-sectional empirical analysis to show that fast-growing developing countries tend to export capital abroad. This finding is hard to square with the standard neoclassical growth model, which predicts that capital should be allocated where productivity growth is highest.

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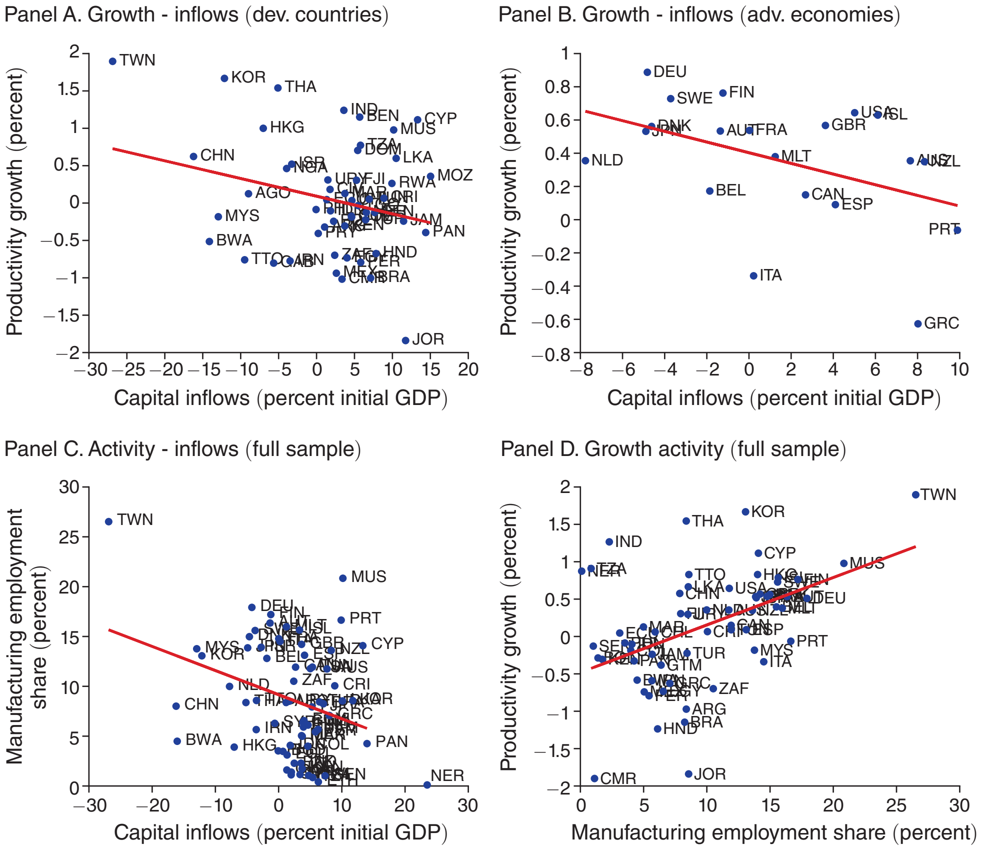
[42] In fact, as we discussed in footnote 30, in steady state the profit effect always dominates the cost of funds effect.

[43] All data used in this article come from the Wealth of Nations database (Lane and Milesi-Ferretti 2022); the Penn World Tables (Feenstra, Inklaar, and Timmer 2022); and the UNIDO INDSTAT2 database (UNIDO 2024). Details can be found in online Appendix F.


Panel A. Growth - inflows (dev. countries)

Panel B. Growth - inflows (adv. economies)

Panel C. Activity - inflows (full sample)

Panel D. Growth activity (full sample)

FIGURE 5. RAW CROSS-SECTIONAL CORRELATIONS

Notes: Panel A shows the correlation between average yearly TFP growth and average yearly capital inflows (in percent of initial GDP) during the period 1980–2019 across a sample of developing countries. Panel B does the same for a sample of advanced economies. Panel C shows the correlation between the average share of employment in manufacturing and capital inflows across our full sample of countries. Panel D shows the correlation between average TFP growth and the average share of employment in manufacturing across our full sample of countries. Solid lines refer to a linear OLS regression between the two variables in each panel.

That is why Gourinchas and Jeanne dub it the *allocation puzzle*. However, the existence of a negative relationship between capital inflows and growth is exactly in line with our framework. We thus take it as the starting point of our empirical analysis.

In Figure 2 of their paper, Gourinchas and Jeanne inspect the raw correlation between average yearly capital inflows (in percent of initial GDP) and average yearly total factor productivity growth over the period 1980–2000 in a sample of developing countries. We perform a similar analysis, but extending the sample to 1980–2019.[44] As in Gourinchas and Jeanne (2013), the correlation between the two variables is negative (Figure 5, panel A). For instance, East Asian countries—which

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[44] Specifically, our measure of capital inflows for a generic country i is $capinf_i \equiv -\sum_{t=0}^{T_i} CA_{i,t}/(T_i Y_{i,0})$, where T_i is the length of the sample for country i, $CA_{i,t}$ denotes the current account in year t, while $Y_{i,0}$ denotes GDP in the initial year. Both variables are expressed in 1980 constant dollars. Productivity growth is instead measured as $growth_i \equiv \log(TFP_{i,T_i}/TFP_{i,0})/T_i$, where TFP denotes total factor productivity. In online Appendix F, we describe in detail all data sources and data manipulation done in this section.

Table 1—Cross-Sectional Growth Regressions

Dependent variable: Total factor productivity growth	(1)	(2)	(3)	(4)
Capital inflows	−0.0253	−0.0253	−0.0166	−0.0123
	(0.0103)	(0.0104)	(0.0113)	(0.0105)
Employment share manufacturing			0.0495	0.0744
			(0.0161)	(0.0170)
Initial productivity		−0.0027		−0.0521
		(0.0152)		(0.0142)
Initial productivity squared		−0.0000		0.0003
		(0.0001)		(0.0001)
Observations	72	72	62	62
R^2	0.0791	0.1110	0.2160	0.3820

Notes: Standard errors in parentheses. All variables are expressed in percent.

experienced fast growth and capital outflows—are clearly visible in the upper left portion of the panel. We then extend the analysis to advanced economies, which are not part of Gourinchas and Jeanne's sample, and show that the allocation puzzle applies also to them (Figure 5, panel B). As an example, notice the contrast between peripheral euro area countries, characterized by low productivity growth and sizable capital inflows, and Germany with its distinctive combination of current account surpluses and fast productivity growth. To save space, in the remainder of this section we pool all countries together.[45]

Our theory proposes a possible explanation for the allocation puzzle: capital inflows reduce economic activity in the tradable sector, while a smaller tradable sector implies lower productivity growth. In our model, the size of the tradable sector is thus negatively correlated with capital inflows, and positively correlated with productivity growth. To measure these correlations in the data, we take the share of employment in manufacturing as our headline measure of economic activity in the tradable sector.[46] Figure 5, panel C shows that capital inflows are associated with a smaller manufacturing sector, while Figure 5, panel D shows that countries with a large manufacturing sector also feature fast productivity growth. Both correlations are consistent with our model.

We next run some additional regressions and report the results in Table 1. In all regressions, the dependent variable is the average yearly growth rate of total factor productivity. Column 1 shows that the negative correlation between capital inflows and productivity growth is statistically significant. In column 2 we control for initial productivity relative to the United States, in levels and squared, as a way to account for a country's distance from the technological frontier. Even after adding these controls, the negative correlation between capital inflows and growth remains statistically significant.[47] Interestingly, the coefficients on initial productivity themselves are not statistically significant, consistent with the lack of unconditional convergence documented by the literature (Rodrik 2012).

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[45] That said, the main results hold also when we analyze separately advanced and developing economies.

[46] We measure the employment share in manufacturing as $share_i \equiv \frac{1}{T_i}\sum_{t=0}^{T_i} \frac{employment\,manufacturing_{i,t}}{employmentt_{i,t}}$.

[47] Gourinchas and Jeanne (2013) show that the allocation puzzle is robust to the addition of a battery of controls.

We repeat the same analysis in columns 3 and 4, but adding the share of employment in manufacturing as an additional control. There are three interesting observations. First, economic activity in the tradable sector is positively related to productivity growth, and the relationship is highly statistically significant. Second, after controlling for the size of the manufacturing sector, capital inflows are no longer significantly associated with productivity growth.[48] This finding is consistent with our theory, in which capital inflows affect growth through their impact on economic activity in the tradable sector. Third, the coefficients on initial productivity are now strongly statistically significant and in line with productivity convergence. This pattern, previously uncovered by Rodrik (2012), suggests that international productivity convergence is mediated by the size of the tradable sector. This is one of the key features of our model.

In online Appendix F.2, we show that the results presented in Table 1 are robust to a number of alternative specifications. In particular, we confirm that the results hold if we replace TFP with labor productivity growth, or the employment share in manufacturing with value added in manufacturing relative to GDP. We also show that the results hold up once we look at labor productivity growth in *manufacturing*, rather than economy-wide growth. Hence, consistent with our model, our results for economy-wide growth do not just reflect sectoral composition effects.

Of course, this evidence cannot be used to establish any causality link and does not represent a formal test of the model. Still, the fact that the data exhibit the long-run correlations implied by our model is encouraging.

B. *Time Series Evidence*

We next exploit the panel structure of our data, and study how capital flows correlate with productivity growth and economic activity in the traded sector within each country over time. We take Müller and Verner (2023) as the starting point of our time series analysis. Looking at a panel of advanced and developing countries, they show that credit booms directed towards the nontradable sector are followed by declines in productivity growth. We follow their approach, but focus on capital inflows rather than credit. In particular, we run a panel regression akin to equation (4) in their paper

$$\Delta_3 tfp_{i,t+h} = \alpha_i^h + \beta_h \times capinf_{i,t} + \varepsilon_{i,t+h}, \tag{43}$$

where the dependent variable is the annualized change in log TFP from year $t-3+h$ to $t+h$. As we did in the last subsection, we use cumulated current account deficits scaled by initial GDP as our capital inflow measure: $capinf_{i,t} = -\sum_{k=0}^{2} CA_{i,t-k}/\left(3Y_{i,t-2}\right)$.[49] In turn, α_i^h is a country fixed effect, allowing for different trends across countries, and β_h is our coefficient of interest.

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[48] Notice that, due to data availability, the sample size shrinks slightly when we add economic activity in manufacturing as a control. However, also in this restricted sample the raw correlation between capital inflows and productivity growth is negative and statistically significant.

[49] In line with Müller and Verner (2023), we focus on medium-run variations in capital flows by considering the average current account deficit over a three-years window, normalized by initial GDP.

Table 2—Time Series Growth Regressions

	$h = 0$	$h = 1$	$h = 2$	$h = 3$	$h = 4$
Panel A. Dependent variable: Total factor productivity growth					
Capital inflows	−0.098	−0.106	−0.084	−0.041	−0.003
	(0.022)	(0.017)	(0.013)	(0.010)	(0.012)
Observations	2,828	2,759	2,690	2,621	2,549
R^2	0.11	0.12	0.11	0.10	0.10
Panel B. Dependent variable: Employment share manufacturing					
Capital inflows	−0.049	−0.051	−0.047	−0.038	−0.024
	(0.0188)	(0.021)	(0.021)	(0.022)	(0.020)
Observations	2,057	1,985	1,920	1,852	1,790
R^2	0.14	0.18	0.21	0.26	0.31

Notes: Regression analysis according to equation (43). Driscoll and Kraay (1998) standard errors in parentheses with lag-length $\mathit{ceil}\big(1.5(3 + h)\big)$. All variables are expressed in percent.

Table 2 shows the results. Consistent with our model, capital inflows are associated with persistent slowdowns in productivity growth. For instance, the estimate $\beta_0 = -0.098$ implies that, over a three-years window, a current account deficit equal to 1 percent of GDP is associated with a drop in productivity growth of about 0.1 percent.

In the bottom rows of the table, we compute the correlation between capital inflows and the share of employment in manufacturing by replacing $\Delta_3 \mathit{tfp}_{i,t+h}$ in (43) with $\mathit{share}_{i,t+h} - \mathit{share}_{i,t-4}$. Again consistent with our model, we find that episodes of capital inflows are accompanied by persistent declines in economic activity in manufacturing.

We study the robustness of our results in online Appendix F.3. We first show that the results hold up once we replace TFP growth with real GDP per capita growth, labor productivity growth, and labor productivity growth in manufacturing. We also show that the results are robust to measuring economic activity in the tradable sector with the value added share of manufacturing in GDP. We then conduct an event analysis, by studying episodes of large capital inflows. Precisely, following Benigno, Converse, and Fornaro (2015), we identify events of large capital inflows as years when the current account ratio is more than one standard deviation below its trend. We then show that during episodes of large capital inflows the manufacturing sector shrinks and productivity growth slows down.

This evidence suggests that, on average, capital inflows are associated with a smaller size of the tradable sector and lower productivity growth. A few other studies have documented similar empirical regularities. The first fact is related to Benigno, Converse, and Fornaro (2015) and Kalantzis (2015), who show that episodes of large capital inflows are associated with a reallocation of productive activities out of manufacturing and towards the nontradable sectors. The second fact is consistent with the evidence by Mian, Sufi, and Verner (2019) and Müller and Verner (2023), who show that credit supply expansions geared toward the household and nontradable sectors are accompanied by a shift of productive resources out of tradable sectors and lower future GDP growth. Bergin, Choi, and Pyun (2023) provide yet more related evidence. Their empirical analysis shows that current account surpluses, driven by accumulation of foreign reserves, are associated with increases in economic activity in manufacturing and accelerations in productivity growth.

Again, this evidence does not establish any causal relation, and cannot be used as a direct test of our model. Still, we think that these empirical regularities are intriguing, because they challenge the standard notion that capital inflows should boost investment and productivity growth. The evidence that we just reviewed suggests a more complex—and less benign—picture, that should be further investigated in future empirical work.[50]

C. *Calibrated Examples*

In this section, we extend the model in several directions and perform a simple calibration exercise. To be clear, the objective of this exercise is not to provide a careful quantitative evaluation of the framework or to replicate any particular historical event. In fact, both of these tasks would require a much richer model. Rather, our aim is to show that the magnitudes implied by the model are quantitatively relevant and reasonable. Throughout, we will focus on the United States—that is the country shaping the world technological frontier—and consider the impact of an increase in the steady state trade deficit. The robust result is that capital inflows may trigger a substantial decline in economic activity in the tradable sector and in aggregate productivity growth. The precise magnitude of these effects, however, depends on how the innovation process is specified. In the interest of space, we limit ourself to sketch out the analysis in the main text, and relegate the details to online Appendix G.

We start by considering a version of the model close to the baseline one, in which innovation activities take place in the tradable sector only. Growth in the tradable sector is now given by

$$g_{u,t+1}^{T} = \beta \frac{c_{u,t}^{T}}{c_{u,t+1}^{T}} \left[\chi^{T} \alpha L_{u,t+1}^{T} + 1 + \lambda \left(g_{u,t+2}^{T} - 1 \right) \right], \tag{44}$$

where $g_{u,t+1}^{T}$ and χ^{T} denote respectively productivity growth and the productivity of research in the tradable sector. λ is a parameter determining the share of knowledge internal to the firm. We introduce it to calibrate a realistic degree of inter-firms knowledge spillovers.[51] As in the baseline model, productivity growth in the nontraded sector is exogenous and constant

$$g_{u,t+1}^{N} = g_{u}^{N}. \tag{45}$$

The only difference is that we allow g_{u}^{N} to differ from 1.

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[50] For instance, it would be interesting to study empirically the impact of capital inflows on sectoral innovation activities, captured by indicators such as R&D spending and patenting. That said, though this is the channel that we chose to emphasize in our model, there are other economic forces that may connect the size of the tradable sector to aggregate productivity growth. Learning by doing externalities in the tradable sector is one example (Krugman 1987).

[51] More precisely, we now assume that productivity of firm j evolves according to

$$A_{u,t+1}^{j,T} = A_{u,t}^{j,T} + \chi^{T} \left(A_{u,t}^{j,T} \right)^{\lambda} \left(A_{u,t}^{T} \right)^{1-\lambda} L_{u,t}^{j,T},$$

where $0 \leq \lambda \leq 1$. So, when investing in innovation, a firm now builds up on its own stock of knowledge $\left(A_{u,t}^{j,T} \right)$ and on the aggregate stock of knowledge in its sector $\left(A_{u,t}^{T} \right)$. A higher λ corresponds to a higher weight on the internal stock of knowledge. Our baseline model corresponds to the case $\lambda = 0$.

As a measure of aggregate growth, we consider the growth rate of real value added in each sector weighted by each sector's employment share.[52] Consistent with national accounting practice (Crawford et al. 2014), we compute aggregate growth by assuming that productivity in the research sector grows at the same rate as in the rest of the economy. Using this definition, aggregate productivity growth $g_{u,t}$ evolves according to

$$g_{u,t} = \frac{L_{u,t}^{T}}{\bar{L}} g_{u,t}^{T} + \frac{L_{u,t}^{N}}{\bar{L}} g_{u,t}^{N} + \frac{L_{u,t}^{R}}{\bar{L}} g_{u,t}. \tag{46}$$

The labor market clearing condition is unchanged relative to the baseline model

$$\bar{L} = L_{u,t}^{T} + L_{u,t}^{N} + L_{u,t}^{R}, \tag{47}$$

where $L_{u,t}^{R} = \left(g_{u,t+1}^{T} - 1\right)/\chi^{T}$. Moreover, labor allocated to the production of nontradable goods is now

$$L_{u,t}^{N} = \frac{1-\omega}{\omega\Psi} c_{u,t}^{T}, \tag{48}$$

which replaces equation (30). Evaluated on the balanced growth path, these five equations determine $g_{u}^{T}, g_{u}^{N}, g_{u}, L_{u}^{T}, L_{u}^{N}$, for given consumption of tradable goods c_{u}^{T}.

How large is the effect of capital inflows on productivity growth in the United States? To obtain some analytic insights, consider a case in which the research sector is small $\left(L_{u,t}^{R} \approx 0\right)$. Under this approximation, one can show that

$$\frac{L_{u,t}^{T}}{\bar{L}} = \omega - (1-\omega) T_{t}, \tag{49}$$

where T_t denotes the trade deficit relative to GDP, which we will take as our measure of capital inflows. As in our baseline model, a higher trade deficit induces a reallocation of labor from the tradable sector to the nontradable one.

Now consider the impact of a permanent increase in T on aggregate productivity growth. Combining (44), (46), and (49), and using again the approximation $L_{u}^{R} \approx 0$, gives

$$\frac{\partial g_u}{\partial T} = -(1-\omega)\left(\underbrace{g_{u}^{T} - g_{u}^{N}}_{\text{reallocation}} + \underbrace{g_{u}^{T} - \frac{\beta(1-\lambda)}{1-\beta\lambda}}_{\text{impact on } g_u^T}\right). \tag{50}$$

There are two effects at play. First, holding constant g_{u}^{T}, the reallocation of labor between the two sectors has a marginal impact on aggregate productivity growth equal to $g_{u}^{T} - g_{u}^{N}$. The second effect, encapsulated by the term $g_{u}^{T} - \beta(1-\lambda)/(1-\beta\lambda)$, captures the negative impact of capital inflows on innovation activities within the tradable sector. In the empirically relevant case $g_{u}^{T} > g_{u}^{N}$, both forces point toward a depressive impact of capital inflows on productivity growth.

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[52] We focus on growth weighted by employment shares to obtain analytic insights. We verified numerically that the results are not much different if we use the Fisher index to compute the growth rate of aggregate GDP, in line with NIPA methodology.

To assess the magnitudes involved, we move away from the approximation $L_u^R \approx 0$ and perform a simple calibration exercise. We set the length of a period to one year, and choose parameter values so that the model under financial autarky matches some statistics inspired by US data. We set $\beta = 0.96$, a standard value at annual frequencies. In the late 1990s, that is at the onset of the global saving glut, the share of manufacturing in GDP in the United States was about 15 percent. We match this statistic by setting $\omega = 0.15$. We set $\alpha = 0.122$, so that spending in innovation by firms in the tradable sector is equal to 1.3 percent of GDP. This is in line with expenditure in R&D by US manufacturing firms in the late 1990s.[53] Kehoe et al. (2018) estimate that between 1992 and 2012 productivity in US manufacturing grew on average by 4.4 percent per year. We thus set $\chi^T = 3.02$ so that $g_u^T = 1.044$ under financial autarky. Again following the empirical evidence provided by Kehoe et al. (2018), we set $g_u^N = 1.011$.[54] The implied aggregate productivity growth under financial autarky is 1.6 percent. We set λ following the empirical estimates provided by Bloom, Lucking, and Van Reenen (2019a) on knowledge spillovers within US firms. They find that, due to knowledge externalities, the social return to R&D is about four times larger than the private one. We match this statistic by setting $\lambda = 0.75$.[55]

We consider the economy's response to a permanent capital inflows shock, defined as follows. The economy starts from the financial autarky steady state. From period 0 on, the economy starts running a permanent trade deficit equal to 2 percent of GDP. In response, the economy immediately jumps to a new steady state. Table 3 compares the steady state under financial autarky against one with a 2 percent trade deficit-to-GDP ratio.

Trade deficits induce a drop in the share of labor allocated to the production of traded goods from 14.8 percent to 13.2 percent. This number is in the ballpark of the estimates provided by Kehoe et al. (2018) on the impact of the global saving glut on manufacturing employment in the United States.[56] As a result of this sectoral labor

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[53] Following standard practice in the endogenous growth literature, we use R&D spending as the data counterpart of the model's investment in innovation. One could argue that innovation activities include other types of investment, often difficult to measure, and so that R&D spending understates actual investment in innovation. That said, targeting a higher level of investment in innovation would not change substantially the results of our calibration exercise.

[54] We take services and construction as the empirical counterparts for the model's nontradable sector. Kehoe et al. (2018) estimate productivity growth in construction and services to be equal respectively to −0.84 and 1.3 percent per year. Construction in the United States is about 5 percent of value added. Given that in our calibration manufacturing is 15 percent of GDP, we then assign the remaining 80 percent of value added to services. This implies $g_u^N = 1.013 \times 0.8/0.85 - 0.9916 \times 0.5/0.85 = 1.011$.

[55] To set λ, we use the fact that on the balanced growth path the private return from R&D is given by

$$r^p \equiv \frac{g_u^T}{\beta} - 1 = \frac{\chi^T \alpha L_u^T + 1 - \lambda}{1 - \beta\lambda} - 1,$$

while the social return, which internalizes the inter-firms knowledge spillovers, is given by

$$r^{sp} \equiv \frac{\chi^T \alpha L_u^T}{1 - \beta} - 1.$$

We set $\lambda = 0.75$ so that $r^{sp} = 4r^p$.

[56] According to their simulations, between 1992 and 2012 the global saving glut on average increased the yearly trade deficit-to-GDP ratio by 3 percentage points, while it lowered the share of employment in manufacturing by 1.2 percentage points. Dix-Carneiro et al. (2023), using a structural model, find a quantitatively similar impact of trade deficits on manufacturing employment in the United States. These estimates are one order of magnitude bigger than the empirical correlations between capital flows and manufacturing employment that we

Table 3—Calibrated Examples

	Baseline		*Low spillovers*		*High spillovers*	
Trade deficit/GDP	0.0	2.0	0.0	2.0	0.0	2.0
Productivity growth						
Aggregate	1.6	1.3	1.6	1.0	1.6	1.4
Tradables	4.4	2.4	4.4	0.5	4.4	3.1
Nontradables	1.1	1.1	1.1	1.1	1.1	1.1
Employment share						
Tradables	14.8	13.2	14.8	13.3	14.8	13.1
Nontradables	83.8	86.0	83.8	86.6	83.7	85.8
Research	1.5	0.8	1.4	0.1	1.5	1.1
Welfare gains	0.0	−4.3	0.0	−10.1	0.0	−1.9

Notes: All the values are expressed in percentage points. Welfare gains are expressed as consumption equivalents with respect to financial autarky.

reallocation, productivity growth in the tradable sector falls from 4.4 percent to 2.4 percent, while aggregate productivity growth drops from 1.6 percent to 1.3 percent. So not only capital inflows depress productivity growth, which runs contrary to conventional wisdom, but they do so by a significant amount. We also find that capital inflows generate sizable welfare losses, corresponding to a permanent 4.3 percent drop in financial-autarky consumption.[57] As we noted in Section II, this perhaps surprising result can be explained by the fact that trade deficits exacerbate private firms' underinvestment in innovation.

It is apparent from expression (50) that the parameter λ, which is admittedly hard to pin down empirically, is an important determinant of the quantitative impact of capital flows on productivity. Intuitively, stronger inter-firms knowledge spillovers reduce the sensitivity of investment in innovation with respect to profits. The third and fourth columns of Table 3 illustrate this result.[58] The "low spillovers" column refers to a case in which the social return to innovation is twice the private return ($\lambda = 0.92$). In this case, capital inflows cause a drop in productivity growth which is twice as large as in the baseline calibration. The "high spillovers" column, instead, refers to a case in which the social return to innovation is eight times larger than the private return ($\lambda = 0.44$). As expected, higher spillovers mitigate the impact of capital inflows on productivity growth, but overall the results are quantitatively similar to the baseline calibration.

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reported in Section IIIB. However, these empirical correlations do not have a causal interpretation, and they pool a variety of episodes heterogeneous both in terms of underlying shocks driving capital flows and countries. It is then not obvious to map these empirical correlations with our quantitative exercise.

[57] We compute the welfare gains from capital inflows as the proportional increase in consumption that households living under financial autarky must receive in order to be indifferent between remaining under financial autarky and switching to an economy receiving capital inflows. Formally, the consumption equivalent η is defined as

$$\sum_{t=0}^{\infty} \beta^t \log\big((1+\eta)\, C^a_{u,t}\big) = \sum_{t=0}^{\infty} \beta^t \log\big(C^f_{u,t}\big),$$

where the superscripts a and f denote allocations respectively in the financial autarky economy and in an economy receiving capital inflows.

[58] To compare economies with the same steady state under financial autarky, as we change λ we also adjust the parameters α and χ^T to hit the calibration targets outlined above.

In online Appendix G, we further explore the quantitative properties of the framework by studying several extensions to the baseline model. In particular, we allow for innovation activities in both sectors, and for inter-sectoral knowledge spillovers. We also consider an economy in which growth is semi-endogenous, and one featuring structural change. The robust result of these exercises is that capital inflows may trigger a persistent decline in economic activity in the tradable sector and in aggregate productivity growth. That said, we view these exercises just as a first pass in analyzing the quantitative properties of our model. Further work, based on richer and more realistic frameworks, is needed to back up the precise magnitudes of the effects that we describe.

IV. Further Implications

We now use the model to shed light on three prominent debates in international macroeconomics. We discuss, first, how the dollar adjusts following financial liberalization, second, why export-led growth by developing countries can backfire, and third, how innovation policies can shield US and global growth from financial globalization. For simplicity, we do so using the baseline model of Section I.

A. *The Real Exchange Rate*

There is a long-standing interest in international macroeconomics on the consequences of capital flows in and out of the United States for the dollar (Obstfeld and Rogoff 2005). We now revisit this issue with the help of our model.[59] It turns out that, in our framework, capital flows toward the United States affect the US real exchange rate through two contrasting channels. On the one hand, a surge in capital inflows sustains demand for US goods and appreciates the US real exchange rate.[60] On the other hand, capital inflows depress US productivity relative to developing countries in the tradable sector, pointing to a depreciation of the US real exchange rate due to the Balassa-Samuelson effect. As we will see, these two effects tend to operate at different horizons, implying a nonmonotonic response of the US real exchange rate to changes in capital flows.

To make these results stand out, we modify our baseline model in one direction. We assume that firms operating in the tradable sector face diminishing returns from employing labor in production.[61] The production function (8) is therefore replaced by

$$Y_{i,t}^{T} = \left[\left(L_{i,t}^{T}\right)^{1-\alpha}\right]^{\gamma} \int_0^1 \left(A_{i,t}^{j}\right)^{1-\alpha} \left(x_{i,t}^{j}\right)^{\alpha} dj, \tag{51}$$

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[59] In a very interesting recent contribution, Gornemann, Guerron-Quintana, and Saffie (2020) study exchange rate dynamics in an endogenous growth model. In their model, movements in the exchange rate are driven by changes in the terms of trade. Our framework, instead, connects the exchange rate to the relative price of traded and nontraded goods. Integrating these two approaches is a promising area of future research.

[60] The reason is that capital inflows foster demand for nontraded goods more than their supply. This channel is also present in Karabarbounis (2014) and Gornemann, Guerron-Quintana, and Saffie (2020).

[61] Results would be similar if we modified the production function in the nontradable sector, or if we modified both production functions simultaneously.

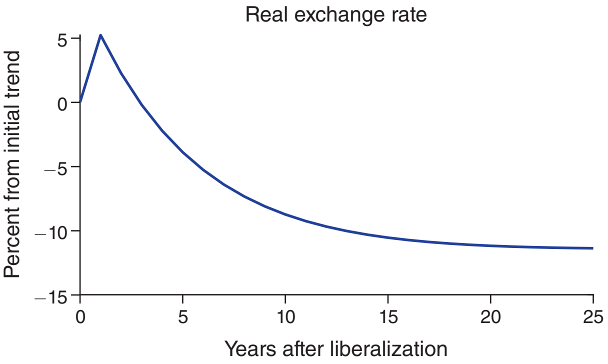

Figure 6. Transition from Autarky to Financial Integration: Real Exchange Rate

Notes: The process of financial integration is captured by a gradual rise in κ_t, which is governed by (42). Financial integration is not anticipated by agents in periods $t < 1$. From period $t = 1$ on agents have perfect foresight.

where $0 < \gamma \leq 1$ captures the extent of decreasing returns. The real exchange rate is proportional to the relative price of consumption in the two groups of countries. In particular, the US real exchange rate is given by

$$\left(\frac{P_{u,t}^N}{P_{d,t}^N}\right)^{1-\omega} = \left(\frac{1}{a_{d,t}}\right)^{1-\omega}\left(\frac{L_{d,t}^T}{L_{u,t}^T}\right)^{(1-\omega)(1-\gamma)}, \tag{52}$$

where recall that $a_{d,t} \equiv A_{d,t}/A_{u,t}$ denotes the proximity of developing countries to the technological frontier.

Equation (52) captures the two competing effects which shape the real exchange rate adjustment. On the one hand, higher demand for non tradables in the United States relative to developing countries appreciates the US exchange rate. This effect is encapsulated by the term $L_{d,t}^T/L_{u,t}^T$ which increases when consumption of non tradables rises in the United States relative to developing countries.[62] On the other hand, a rise in developing countries' proximity to the frontier—that is, a rise in $a_{d,t}$—depreciates the US real exchange rate. This is the Balassa-Samuelson effect.

We illustrate these effects in Figure 6, which shows the equilibrium path of the US real exchange rate following financial integration. Specifically, in the figure, we repeat the experiment from Section IIC, but we assume for the sake of illustration that $\gamma = 0.8$, such that labor is characterized by decreasing returns. The figure shows that the US real exchange rate first appreciates, but eventually depreciates.[63] This happens because it takes time for firms' investment to affect productivity. So, on impact, only the demand effect operates. The Balassa-Samuelson effect, instead, becomes stronger over time, and it dominates the demand one in the long run. Our model thus shows that, due to the endogenous productivity dynamics, the exchange rate response to capital flows may be nonmonotonic and time dependent.

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[62] Note that in our baseline model ($\gamma = 1$), this effect is not visible in equilibrium. Intuitively, when the production function is linear, the sectoral labor allocation adjusts exactly so as to offset the impact of changes in demand on the relative price of nontradable goods.

[63] The empirical evidence, in fact, suggests that on impact capital inflows are associated with real exchange rate appreciations (Benigno, Converse, and Fornaro 2015).

B. *Export-Led Growth by Developing Countries*

A widespread belief, especially in policy circles, is that productivity growth in developing countries can be fostered by policies that stimulate trade surpluses.[64] Perhaps surprisingly, little research has been devoted to assess the viability of this growth strategy when implemented on a global scale. In this section, we revisit this question through the lens of our framework. To do so, we trace the impact on the global economy of an increase in τ, that is an increase in the subsidy provided by governments in developing countries on capital outflows.

Let us start by focusing on the steady state. Combining (38) and (40) gives

$$a_{d,f}^{\phi} = \frac{\xi\left(\bar{L} + \frac{\Gamma\kappa\left[\beta(1+\tau)-1\right]}{a_{d,f}}\right)}{\chi\left(\bar{L} - \Gamma\kappa\left[\beta(1+\tau)-1\right]\right)}. \tag{53}$$

This expression implies that a rise in τ increases developing countries' proximity to the technological frontier. This result squares well with the notion of export-led growth. By subsidizing capital outflows, governments in developing countries increase economic activity in the tradable sector. As a consequence, investment in technology adoption rises, growth accelerates in the medium run, and the gap with the technological frontier gets smaller. An export-led growth strategy might thus be successful in raising productivity growth in the medium run.

The story, however, does not stop here. From equation (38), it is immediate to see that a rise in τ lowers the rate of productivity growth in the United States. Capital inflows cause the tradable sector in the United States to shrink, inducing a drop in investment in innovation by US firms. Through this effect, the export-led growth strategy pursued by developing countries depresses productivity growth in the United States. But US innovation determines the world technological frontier, and thus the scope for technology adoption by developing countries. The result is that over time productivity growth in developing countries declines, and eventually converges to that of the United States In the long run, therefore, an export-led growth strategy might backfire and cause a drop in global productivity growth.

These negative effects of export-led growth arise when this strategy is implemented on a global scale. To see this point, imagine that the developing countries region is composed of a continuum of small open economies. Then, an increase in the subsidy to capital outflows by a single country does not affect the rest of the world at all. Capital outflows from a single small open economy, in fact, are not large enough to affect economic activity in the United States. But this logic suggests that developing countries may fall in a coordination trap. A single small country, in fact, does not internalize the impact of its policies on the growth rate of the world

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[64] For instance, Dooley, Folkerts-Landau, and Garber (2004) put this notion at the center of their Bretton Woods II perspective on the international monetary system. They argue that governments in East Asian countries have based their development strategy on export-led growth, supported by policies (such as capital controls and accumulation of foreign reserve assets) encouraging capital outflows toward the United States. Consistent with this hypothesis, Alfaro, Kalemli-Özcan, and Volosovych (2014) show that the positive correlation between capital outflows and productivity growth observed in developing countries is driven by public flows—especially in the form of large foreign reserve accumulation by the public sector of fast-growing East Asian economies.

technological frontier.[65] Therefore, avoiding the negative side effects triggered by export-led growth might require coordination among developing countries.

C. *Innovation Policies in the United States*

Governments frequently implement policies to foster innovation activities (Bloom, Van Reenen, and Williams 2019b). While innovation policies have been studied in the context of trade liberalization (Akcigit, Ates, and Impullitti 2018) or business cycle stabilization (Benigno and Fornaro 2018), little is known about their relationship with capital flows. We now take a first stab at this issue, by showing how innovation policies can be designed in order to insulate US productivity growth from the negative impact of financial globalization.

Imagine that the US government subsidizes spending on innovation at rate $\iota_{u,t}$, so that equation (15) is replaced by

$$(1-\iota_{u,t})\frac{W_{u,t}}{\chi A_{u,t}} = \frac{\beta C^T_{u,t}}{C^T_{u,t+1}}\left(\varpi L^T_{u,t+1} + (1-\iota_{u,t+1})\frac{W_{u,t+1}}{\chi A_{u,t+1}}\right). \tag{54}$$

The subsidy $\iota_{u,t}$ is financed with lump-sum taxes on US households. Now assume that, once the financial integration steady state is reached, the US government subsidizes spending on innovation at rate

$$\iota_{u,f} = \frac{\chi\Gamma(1-\alpha\beta+\Gamma\Psi)}{(1+\Gamma\Psi)(\chi\bar{L}+1-\beta)}\kappa\left[\beta(1+\tau)-1\right]. \tag{55}$$

This policy intervention implies that $g_f = g_a$,[66] and so that steady state growth is not affected by international capital flows. Notice that $\iota_{u,f}$ is increasing in the US trade deficit, as captured by the term $\kappa\left[\beta(1+\tau)-1\right]$. As argued above, in steady state a larger US trade deficit is associated with lower incentives to innovate by US firms. To counteract this effect, the US government has to respond to larger capital inflows with more aggressive subsidies to innovation.

Interestingly, with this policy in place financial globalization is associated with an acceleration in global growth in the medium run. The reason is that financial globalization triggers an expansion in the tradable sector in developing countries, encouraging technology adoption by developing countries' firms and pushing them closer to the technological frontier. These results suggest that it is possible to couple financial globalization and a global saving glut with robust productivity growth.

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[65] Even the government of a country, large enough to internalize the impact of its policies on the world technological frontier, would have no incentives to take into account how its actions affect welfare in the rest of the world. Hence, also large developing countries might gain from coordinating their policy interventions.

[66] With the subsidy in place, equation (GG_u) is replaced by

$$g(1-\iota_u) = \beta\left[\chi\alpha L^T_u + (1-\iota_u)\right].$$

To derive the result for $\iota_{u,f}$, we re-derive equation (38) by assuming that $\iota_{u,a} = 0$, but that $\iota_{u,f} > 0$. We then set $g_f = g_a$ in this equation and solve for the implied level of $\iota_{u,f}$.

However, for this to happen, governments might need to implement policies supporting investment in innovation.

V. Conclusion

In this paper, we have presented a model to study the impact of the global saving glut on global productivity growth. We have shown that capital flows from developing countries to the United States can generate a global productivity growth slowdown, by triggering a fall in economic activity in the US tradable sectors. We have dubbed this effect the global financial resource curse.

This paper represents just a first step in a broader research agenda. For instance, here we have just touched on the issue of policy interventions. But the world that we describe is ripe with externalities and international spillovers. It would then be interesting to use our model to design optimal policies to manage financial globalization. Moreover, in this paper we have abstracted from the impact of demand factors on aggregate employment. However, low interest rates are a key feature of our narrative. If equilibrium interest rates are too low, monetary policy might be unable to maintain full employment because of the zero lower bound constraint on nominal rates. To study these effects one should integrate nominal rigidities in this framework, in the spirit of the Keynesian growth model developed by Benigno and Fornaro (2018). This represents a promising area for future research.

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