Unbalanced Financial Globalization

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October 2023

Abstract

We examine the impact of the last five decades of financial globalization on world GDP and income distribution using a novel multi-country dynamic equilibrium model. We introduce new country-specific measures of inward and outward Revealed Capital Account Openness (RKO), derived from wedge accounting, and based on data available since 1970, such as national income accounts and external assets and liabilities positions. Our analysis reveals striking heterogeneity in the pace of capital account liberalization, with wealthier countries experiencing faster liberalization — a finding we term "Unbalanced Financial Globalization." Compared to a counterfactual scenario in which RKO levels remain constant at their pre-globalization levels, we find that unbalanced financial globalization has led to a worsening of capital allocation, a 2.8% lower world GDP, a 12% increase in cross-country income inequality, decreased wages in poorer nations, and reduced borrowing costs for wealthier countries. These results contrast sharply with standard models assuming symmetrical declines in capital account barriers. In hypothetical scenarios of symmetric or convergent capital account liberalizations, we observe enhanced capital allocation efficiency, reduced income inequality, and higher wages in low-income countries. Our study highlights the crucial role of country-specific policies and disparities in shaping the real-world impacts of capital market integration.

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We thank Ricardo Reyes-Heroles, Olivier Jeanne, Dima Mukhin and Elisa Giannone for their thoughtful conference discussions, as well as Markus Brunnermeier, Anusha Chari, Fabrizio Perri, Gita Gopinath, Oleg Itskhoki, Vincenzo Quadrini, and several other conference/seminar participants for comments and feedback. All errors are our own. The views expressed therein are those of the authors and do not necessarily represent the views of the IMF, its Executive Board, or IMF management.

1 Introduction

Over the last five decades, cross-border investment has undergone a tremendous expansion. While the world's total external assets and liabilities represented only about half of world GDP in 1971, by 2019 that number had increased to over 300%. World capital markets have evolved from a state of near-autarky to a situation where, for the typical country, foreign investors fund over half the national capital stock. Such a dramatic shift in the international allocation of capital had the potential to exert a major impact on factor prices, income distribution, and real economic activity. While the previous literature has investigated the effects of specific policy changes or studied capital account liberalization episodes in specific countries, we know remarkably little about how and to what extent financial globalization has reshaped the global allocation of capital and economic activity.

In this paper, we provide a quantitative retrospective assessment of the implications of the five decades of financial integration that have followed the collapse of the Bretton Woods system (1971-2019). Specifically, we study the implication for capital allocation efficiency, income distribution and factor prices.

We start by introducing a novel multi-country, dynamic general equilibrium model that incorporates a logit demand system for international assets, in the style of Koijen and Yogo (2019), and which endogenously generates a network of bilateral investment flows between countries. We then perform a wedge accounting exercise (Chari, Kehoe, and McGrattan, 2007). By fitting the model's equilibrium path of production, saving, capital, and international investment to the actual data, we are able to define and estimate time-varying, country-level measures of inward and outward *Revealed Capital Account Openness* (RKO).

Similarly to how Revealed Comparative Advantage (Balassa, 1965) leverages observed international trade data to infer the comparative advantage of nations in various industries through the lens of a trade model, our RKO wedges leverage data on external assets and liabilities positions and other macroeconomic aggregates to summarize, through the lens of our model, all of the frictions affecting incoming and outgoing foreign investment. These wedges can be readily interpreted as the implied tax on foreign capital income that rationalizes the observed external positions. Intuitively, we infer that a country has high barriers to incoming foreign investments if its external liability is lower than what the model predicts given the observed external assets of all other countries and the model-implied share of their portfolio invested into this country. Likewise, the observed domestic portfolio share in excess of that predicted by a frictionless model identifies barriers to outgoing foreign investment.

Our methodological approach offers a solution to two key empirical challenges. First, within each country, a myriad of policies affects the degree of financial openness and it would be impossible to simultaneously model all of them. Our RKO wedges elegantly summarize all these distortions into an easily-interpretable shadow tax. Second, the task of unravelling the effects of financial globalization is complicated by the lack of cross-border bilateral investments data, which is not available as early as the 1970s. The appeal of our measurement framework is that it requires little data - namely, panel national accounts and external assets and liabilities positions. This data is available since 1970 for a total of 58 countries.

We validate our approach by showing that the estimated wedges correlate with several known barriers to international investment, including measures of de jure capital controls, capital taxation and political risk, and then proceed to study the evolution of our RKO wedges over time. We find that the average implicit tax faced by investors to invest abroad has been steadily decreasing by a cumulative 18 percentage points from 1970 to 2019, a clear manifestation of the financial globalization that has unfolded over the past five decades.

At the same time, we document significant heterogeneity in the pace of capital account opening across countries. Specifically, high-income countries have increased their inward and outward openness faster than low-income ones, a phenomenon we refer to as *Unbalanced Financial Globalization.*

Finally, we use our model to draw the implications of this unbalanced financial globalization. To do so, we construct a counterfactual path of the global economy without financial globalization, one in which we hold the RKO wedges fixed at their 1970 levels throughout the five decades of our sample. By comparing this counterfactual to the observed path of the world economy, we are able to quantify the effects of financial globalization. We obtain three key findings.

Firstly, we find that this uneven decline in barriers has resulted in a worsening of the allocation of capital across countries and a lower world output. Had the RKO wedges stayed at their 1970 levels, global output in 2019 would be 1.4% higher. The key economic mechanism behind this finding is that countries with initially high levels of revealed capital account openness (typically, high-income countries) have outpaced the others in further opening up their capital account. Unbalanced financial globalization thus exacerbated existing differences in de facto capital account openness across countries. By raising the perceived rates of returns on their capital stock relative to those in low-income countries, high-income countries were able to attract investment from the rest of the world. As a result, capital has migrated from capital-scarce to capital-rich countries, leading to a worse allocation of capital and further pushing down the local rate of returns to capital in high-income countries. While this result is consistent with the Lucas puzzle (Lucas, 1990) and several previous papers that have documented higher observed returns on capital in emerging markets (David, Henriksen, and Simonovska, 2014; Monge-Naranjo, Sánchez, and Santaeulalia-Llopis, 2019)—a likely sign of capital misallocation— we are the first to relate this misallocation to the progressive and uneven decline of capital market frictions.

Second, we find that unbalanced financial globalization has contributed to a widening of income gaps between rich and poor countries. The variance of (log) output per worker in 2019 is 9.8% higher than it would have been in a world with no financial globalization. Third, regarding labor and capital remuneration, we find that financial globalization has lowered wages and increased the return to capital in low-income countries. Relative to our counterfactual no-financial globalization scenario, wages in low-income countries are lower by as much as 10% in 2019, while the rate of return on capital is higher by as much as 6.9%. The opposite is true in high-income countries: there, wages are 3.3% higher while the rate of return on capital is 12.8% lower than in the counterfactual scenario. While the returns on capital in high-income countries have declined due to the influx of capital, the returns on portfolio of capital-owners have increased due to the increased opportunities to invest in higher-return countries.

These results stand in sharp contrast with the canonical view that the decline in the barriers to asset trade should improve the allocation of capital, increase world output and reduce income gaps across countries. At the core of this apparent contradiction lies a key insight summarized by our notion of *unbalanced* financial globalization: capital account liberalization has not unfolded at the same pace everywhere, an implicit assumption of models that lack country-level details. In this paper, we show that this unevenness has first-order quantitative implications for capital allocation and factor remuneration.

To further explore the implications of the unevenness of financial globalization across countries, and to reconcile our findings with the existing literature on financial liberalization, we conclude our analysis by quantifying two alternative scenarios: one where RKO wedges improve evenly and one where they converge altogether. We find that a balanced financial globalization would have raised the world output and decreased inequality, consistent with the canonical model. Our findings highlight the need to coordinate current account liberalization policies at the global level.

Related literature. This paper contributes to the rich literature dedicated to studying the drivers and effects of financial globalization. Lane and Milesi-Ferretti (2008) and Lane and Milesi-Ferretti (2018) provide an empirical investigation of the patterns of financial globalization. We extensively use their data on external assets and liabilities in this paper. Henry (2007) and Chari et al. (2012) show that when emerging economies open up their stock market to capital inflows, growth and wages increase temporarily. At a microeconomic level, Forbes (2007) concludes that financial opening in emerging countries is associated with a decline in the cost of capital. Extensive reviews and discussions of the literature are provided by Ghosh et al. (2010), Magud et al. (2018) and Erten et al. (2021). The range of estimates and conclusions is wide and there is little consensus in the literature, which reflects different definitions of capital flows and different sample of countries used by different papers (Forbes, 2007) as well as the endogeneity of financial liberalization episodes and the multiplicity of channels through which they affect the economy.

On the theoretical side, Mendoza and Quadrini (2010) and Broner and Ventura (2016) show, respectively, how financial development and contracting institutions can play an important role in mediating the effects of financial globalization. Boyd and Smith (1997) provide a model where financial integration precludes two countries that only differ from their initial capital stock from converging to the same steady state.

We also connect to the literature on the distributional consequences of financial globalization: Furceri and Loungani (2018) and Furceri, Loungani, and Ostry (2019) find that episodes of financial liberalization are associated with an increase in the Gini coefficient. The analysis by Azzimonti, De Francisco, and Quadrini (2014) emphasizes the role of public debt. Eichengreen et al. (2021) review the literature and find that the effect of globalization on inequality depends on the context and the composition of flows.

Methodologically, our work relates to a stream of papers that develop a wedge accounting framework in an international macro-finance context, such as Gourinchas and Jeanne (2013) on the capital allocation puzzle, Gârleanu, Panageas, and Yu (2019) on information asymmetry and under-diversification, and Ohanian, Restrepo-Echavarria, Van Patten, and Wright (2021) on capital account controls in the Bretton Woods era. Relative to the latter paper, our focus is on the implications of financial globalization in the post Bretton Woods era. Our model differs from all these papers in that we incorporate an asset demand framework and we adopt a spatial-structural approach, which is inspired from the trade literature on comparative advantage (Balassa, 1965; Koopman, Wang, and Wei, 2014). This approach allows us to estimate the revealed capital account openness wedges in a transparent way, and to perform detailed quantifications with rich country heterogeneity.

We contribute to the recent set of papers that develop asset demand frameworks in international finance, like Koijen and Yogo (2020), Pellegrino, Spolaore, and Wacziarg (2021) and Jiang, Richmond, and Zhang (2022). Our findings are consistent with those of PSW: we both find that barriers to international investment misallocate capital from low-income towards high-income countries. The novel insight of this paper is to show how financial globalization has worsened this misallocation over time, as capital account liberalization has proceeded faster in high-income countries than it has in low-income ones.

The remainder of the paper is organized as follows. Section 2 introduces the model of the world economy with cross-border investments and explains the methodology and the data used to back out the RKO wedges. Section 3 introduces the data used for the estimation of the model and illustrates the wedge accounting methodology. In Section 6 we document trends in the RKO wedges, and detail the evolution of unbalanced financial globalization. In Section 7 we use counterfactual analysis to distill its implications. In Section 9 we conclude.

2 A Dynamic Model of International Capital Allocation

In this section, we introduce a novel multi-country, dynamic general equilibrium model that incorporates a logit demand system for international assets, in the style of Koijen and Yogo (2019), and which endogenously generates a network of bilateral investment flows between countries. We will use it in the following section to develop our wedge accounting framework.

2.1 Production

Time is discrete and indexed by t. The world economy is made of n countries. We use the subscript $i \in \{1, 2, ..., n\}$ to denote the country that receives the investment, and the subscript $j \in \{1, 2, ..., n\}$ to denote the country where investors are located. For example, A_{ijt} denotes the aggregate investment from j to i at time t.

In each country, there is a representative firm that produces a homogeneous tradable good (which is the numéraire of this economy and thus has price 1) using a three-input Cobb-Douglas production function:

$$Y_{it} \;=\; \Omega_{it}\, K_{it}^{\kappa_{it}}\, L_{it}^{\lambda_{it}}\, X_{it}^{\xi_{it}} \tag{2.1}$$

where K_{it} is the reproducible capital in country i, L_{it} is human capital input and X_{it} is the stock of natural resources.[1] Consistently with the previous literature on international capital allocation, we assume that the amount of labor and natural capital available at time t are exogenous and immobile, while reproducible capital can be accumulated and investment can occur from one country to another – i.e. capital is mobile. Production implies the deprecition of an exogenous fraction δ_t of the capital stock.

Capital investors are residual claimants on the profits of the representative firm. Taking the wage rate P_{jt}^{L} and the rental rate of natural resources P_{jt}^{X} as given, the representative firm i maximizes profits (Π_i), which are defined as follows:

$$\Pi_{it} \;\stackrel{\text{def}}{=}\; \max_{L_{it}, X_{it}} \; Y_{it} - P_{it}^{L} L_{it} - P_{it}^{X} X_{it} \tag{2.2}$$

At the optimum, firms equate the marginal product of each input to its cost:

$$P_{it}^{L} \;=\; \lambda_{it} \frac{Y_{it}}{L_{it}}; \qquad P_{it}^{X} \;=\; \xi_{it} \frac{Y_{it}}{X_{it}}; \tag{2.3}$$

we call the marginal product of capital r_{it}. It is also the profit per unit of capital invested.

$$r_{it} \quad \stackrel{\text{def}}{=} \quad \kappa_{it} \frac{Y_{it}}{K_{it}} \quad \equiv \quad \frac{\Pi_{it}}{K_{it}} \tag{2.4}$$

The aggregate resource constraint is:

$$\sum_{i=1}^{n} Y_{it} + (1 - \delta_t) K_{it} + \mathcal{E}_{it} \quad = \quad \sum_{i=1}^{n} C_{it} + K_{it+1} \tag{2.5}$$

where C_{it} is the aggregate consumption of country i at time t, and $\mathcal{E}_{it}$ is an exogenous endowment of output

[1] We include natural resources as a separate variable from reproducible capital because accounting for rents from natural resources can significantly affect the measurement of the rate of return on reproducible capital and the elasticity of output to capital (Monge-Naranjo et al., 2019).

in country i at time t, a residual source of income that we introduce so that equation (2.5) exactly holds in the data.

2.2 Households

Next, we model the behavior of the agents who populate our economy, and embed in it the asset demand framework of Koijen and Yogo (2019, henceforth KY). In each year t, and in each country j, a representative agent is born; we index this agent with the time of birth b. Each period, all individuals face a probability of death $\mathfrak{D}_{jt} \in (0, 1)$. This probability of death and the expected longevity is independent of age as in the perpetual youth model of Yaari (1965) and Blanchard (1985).

The representative agent of each cohort and country seeks to maximize the expected discounted sum of utility from consumption, C_{jbt}. In recursive form, at time t the utility of the representative agent born at time b located in country j is given by:

$$V_{jbt} \quad \stackrel{\text{def}}{=} \quad (1 - \sigma_{jt}) \log C_{jbt} + \sigma_{jt} \; \mathbb{E}_{jt} \left(V_{jbt+1} \right) \tag{2.6}$$

where the weighting parameter σ_{jt} is the country and time-specific discount parameter, adjusted for the risk of death

$$\sigma_{jt} = \frac{\theta_{jt} \left(1 - \mathfrak{D}_{jt}\right)}{1 + \theta_{jt}(1 - \mathfrak{D}_{jt})} \tag{2.7}$$

where $\theta_{jt}$is a time-varying patience parameter. Note that we have normalized the value of death to 0 and we conveniently defined σ_{jt} so that the discount rate is equal to $\theta_{jt} \left(1 - \mathfrak{D}_{jt}\right)$. The operator $\mathbb{E}_{jt}$ denotes taking expectations under country$j$'s probability measure at time t, including the distribution of portfolio returns and we assume that all cohorts in country j hold identical beliefs.

In the first year of their life $(t = b)$ the newly born representative agent is endowed with L_{jbt} units of labor and X_{jbt} units of natural resources. They supply both inelastically to firms, from which they collect labor earnings $P^{L}_{jbt} L_{jbt}$, and natural resources rents $P^{X}_{jbt} X_{jbt}$. In the first period of their life, they also receive government transfers (T_{jbt}) and an exogenous endowment $(\mathcal{E}_{jbt})$. In all following periods $(t > b)$ agents live off capital income, namely $L_{jbt} = X_{jbt} = 0$ for $t > b$. The youngest cohorts are thus workers while older cohorts are capitalists.[2]

Every period, agents choose how much of the final good to consume (C_{jbt}), how much to save in the form of capital (A^{-}_{jbt}) and how to allocate their wealth across different assets. We denote A^{-}_{jbt} the amount of capital saved at time t by the representative agent born at time b in country j; we denote by A^{+}_{jtb} the terminal value of the wealth saved at time $(t-1)$, which includes capital income. Our notation follows that of KY, except for the introduction of the $(^{+}, ^{-})$ superscripts. We use these superscripts to capture the fact that, in our setting, the agent's portfolios are *not* self-financing - that is, agents might add funds to the invested wealth or withdraw them between periods. By definition, the investor j's portfolio would be self-financing if $A^{+}_{jbt} = A^{-}_{jbt}$. We use the $(^{+}, ^{-})$ superscripts to highlight that A^{-}_{jbt} is associated with a negative cashflow (cash is converted into portfolio holdings), while A^{+}_{jbt} is associated with a positive cashflow (the liquidation of the portfolio holdings at the end of the investment period).

Each period, agents also have to decide how to allocate their savings across n different assets, which correspond to the capital of firms operating in each destination country and we denote $\mathbf{w}_{jtb}$ the vector of portfolio

[2] This assumption allows us to seamlessly integrate KY's asset demand framework in a dynamic GE model that can be solved globally outside of steady-state in closed form and that can thus be inverted to perform wedge accounting.

shares. The representative agent born at time b in country j thus seeks to maximize its expected utility 2.6 subject to:

$$A^+_{jbt+1} \;=\; (\mathbf{w}_{jbt+1} \cdot \mathbf{R}_{jbt+1})\, A^-_{jbt} \tag{2.8}$$

$$C_{jbt} + A^-_{jbt} \;=\; \begin{cases} P^L_{jbt} L_{jbt} + P^X_{jbt} X_{jbt} + T_{jbt} + \mathcal{E}_{jbt} & \text{if} \quad t = b \\ A^+_{jbt} & \text{if} \quad t > b \end{cases} \tag{2.9}$$

$$\mathbf{w}_{jbt+1} \in \Delta^n \qquad (\Delta^n \text{ is the } n\text{−simplex}) \tag{2.10}$$

where $\mathbf{w}_{jbt+1}$ is the vector of portfolio weights and $\mathbf{R}_{jt+1}$ is the vector of (stochastic) net asset returns at time $t+1$. Net asset returns are net of capital depreciation and of the implicit taxes to international investment which we introduce in the following section. The first constraint defines the return on the agent's entire portfolio; and the second is the time t budget constraint. The third constraint says that portfolio weights should sum to unity and cannot be negative (short-sale constraints), as in KY.

We then build aggregate variables by summing across cohorts within each country. Aggregate consumption and wealth are given by

$$C_{jt} \stackrel{\text{def}}{=} \sum_{b \le t} C_{jbt}; \qquad A^-_{jt} \stackrel{\text{def}}{=} \sum_{b \le t} A^-_{jbt}; \qquad A^+_{jt} \stackrel{\text{def}}{=} \sum_{b \le t} A^+_{jbt}. \tag{2.11}$$

By contrast, since only the youngest cohort supply labor and resources and receive an endowment and government transfers, aggregate natural resources X_{jt}, labor L_{jt}, transfers T_{jt} and endowments $\mathcal{E}_{jt}$ are simply given by

$$X_{jt} \;=\; X_{jtt}; \qquad L_{jt} \;=\; L_{jtt}; \qquad T_{jt} \;=\; T_{jtt}; \qquad \mathcal{E}_{jt} \;=\; \mathcal{E}_{jtt}. \tag{2.12}$$

2.3 Optimal Saving and Consumption

An appealing feature of the class of models with unitary elasticity of intertemporal substitution and risk-aversion is that it yields a simple analytical expression for the optimal saving rate. All cohorts of agents save the same fraction s_{jt} of their income and consume the rest (see Appendix B for a formal proof). This fraction is given by

$$s_{jt} = \sigma_{jt} \tag{2.13}$$

and aggregate saving and consumption are equal to:

$$A^-_{jt} \;\stackrel{\text{def}}{=}\; \sum_{b \le t} A^-_{jbt} \;=\; \sigma_{jt} \left(A^+_{jt} + P^L_{jt} L_{jt} + P^X_{jt} X_{jt} + \mathcal{E}_{jt} \right) \tag{2.14}$$

$$C_{jt} \;\stackrel{\text{def}}{=}\; \sum_{b \le t} C_{jbt} \;=\; (1 - \sigma_{jt}) \left(A^+_{jt} + P^L_{jt} L_{jt} + P^X_{jt} X_{jt} + \mathcal{E}_{jt} \right). \tag{2.15}$$

In addition, we show that the value V_{jbt} is log-linear in wealth A^+_{jbt}:

$$V_{jbt} = \log(A^{+}_{jbt}) + \eta_{0jt} \tag{2.16}$$

where the expression for η_{0jt} is given in Appendix. This expression will prove useful when we solve the optimal portfolio problem, to which we now turn.

2.4 Asset Demand and Portfolio Shares

We now consider the agents' portfolio decision. When agents in j invest in country i, they receive, for every unit of capital invested, a proportional share of the profits and un-depreciated capital. However, agents face investment frictions. Specifically, we assume that the capital income of country i that is owed to investors from country j is subject to: 1) a stochastic repatriation wedge ζ_{it}, that is unknown at time $t-1$ and has mean one; 2) a deterministic wedge on capital income τ_{ijt}, which is known at time $t-1$. The stochastic wedge ζ_{it} makes capital income risky and is a tractable and reduced-form way to model financial markets risk, that still allows us to quantify our model, despite data limitations. At time t, the financial return (R_{ijbt}) from investing a unit of capital in country i is related to the physical marginal rate of return (r_{it}) by the following equation:

$$R_{ijbt} \;=\; \zeta_{ibt}\left(1 + \tau_{ijt} r_{it} - \delta_t\right) \tag{2.17}$$

We assume that both the stochastic, ζ_{ibt}, and the deterministic wedges, τ_{ijt}, are rebated back to the newly born households as lump sum transfers (see Section 2.6). They therefore distort portfolios, but they do not impact the aggregate resource constraint.

As shown in equation 2.16, the portfolio that maximizes the agents' expected value coincides with the portfolio that maximizes the agents' expected (log) value of wealth. We can write the asset allocation problem as:

$$\max_{\mathbf{w}_{jbt+1} \in \Delta^n} \mathbb{E}_{jt}\left(\log A^{+}_{jbt+1}\right) \tag{2.18}$$

Now, following KY, suppose that, at time t, the information set of investors in country j about country i used to forecast R_{ijbt+1} is given by the following vector of variables:

$$\hat{\mathbf{x}}_{it} \;=\; \left[\begin{array}{ccc} k_{it+1} & \mathbf{x}_{it} & \log\left(\epsilon_{ijt}\right) \end{array}\right]' \tag{2.19}$$

where $k_{it+1} \overset{\text{def}}{=} \log K_{it+1}$ and $\mathbf{x}_{ijt}$ is a vector of other observed characteristics of country i at date t. ϵ_{ijt} is a characteristic that captures investor heterogeneity across countries (it is allowed to be ij-specific), it is known to the investors but unknown to us. Here we follow KY in separating size (k_{it+1}) from the other characteristics. The fact that $\hat{\mathbf{x}}_{it}$ includes the "gravity" term k_{it+1} implies that each investor has rational expectations about the aggregate capital stock in each country. It is also consistent with several empirical studies that have confirmed the importance of country size in explaining international portfolios (Portes and Rey, 2005).

Importantly, this asset allocation problem of agent j is exactly analogous to the one analyzed by KY. They show that, under certain restrictions, including that ζ_{it} has a one-factor structure and that its expectations and factor loadings depend on $\hat{\mathbf{x}}_{ijt}$ alone, the optimal portfolio of investors located in j can be approximated by the following hedonic-logit specification:

$$w_{ijt} \;=\; \frac{\exp\left(\beta_0 k_{it} + \beta_1' \mathbf{x}_{it}\right) \cdot \epsilon_{ijt}}{\sum_{\iota=1}^{n} \exp\left(\beta_0 k_{\iota t} + \beta_1' \mathbf{x}_{\iota t}\right) \cdot \epsilon_{\iota jt}}. \tag{2.20}$$

Our choice of which characteristics to include is informed both by data availability as well as by our own judgement of what information the investors can reasonably use to forecast next period returns. Note that investors can forecast the marginal returns of capital r_{it+1}, given their forecast of the capital stock, provided they know profits, or output as shown in equation 2.4. It is therefore natural to assume that the vector of characteristics $\mathbf{x}_t$ includes r_{it+1}. At the same time, the origin-specific component (ϵ_{ijt}) must contain the predictable wedge τ_{ijt}. We thus impose:

$$\mathbf{x}_{it} \;=\; \log r_{it+1}; \qquad \log\left(\epsilon_{ijt}\right) \;\propto\; \tau_{ijt+1}; \tag{2.21}$$

This is the baseline specification that we take to the data. We are however not married to this particular specification and if we had additional data available, we could expand the set of variables included in $\mathbf{x}_{it}$. Under these assumptions, we obtain the following equilibrium portfolio shares:

$$w_{ijt} \;=\; \frac{\left(\tau_{ijt}\, r_{it}\right)^{\beta_1} K_{it}^{\beta_0}}{\sum_{\iota=1}^{n} \left(\tau_{\iota jt}\, r_{\iota t}\right)^{\beta_1} K_{\iota t}^{\beta_0}} \tag{2.22}$$

This logit formulation is a feature of several recent models of demand for international assets (Koijen and Yogo, 2020; Pellegrino et al., 2021; Jiang et al., 2022). There are two factors that make this asset demand framework especially attractive in our setting. First, it can be quantified using the limited data available since the 1970. Second, in the next subsection, we show that under the parametrization $\beta_0 = 1$ (which we refer to as the *Gravity* condition), the model provides a natural interpretation of the wedge τ_{ijt} as a summary statistic of all frictions that distort the international allocation of capital. This parametrization is supported by existing empirical evidence on the directions of capital flows (Portes and Rey, 2005), and we will use it in our quantitative section.

2.5 International Capital Markets Clearing

Next, we analyze the world market clearing conditions for capital. Let $A^-_{ijt} = w_{ijt} A^-_{jt}$ be the asset position of country j in country i at time t. Market clearing implies

$$K_{it} \;=\; \sum_{j=1}^{n} A^-_{ijt}; \qquad A^-_{jt} \;=\; \sum_{i=1}^{n} A^-_{ijt} \tag{2.23}$$

which can be rewritten in matrix form as follows:

$$\mathbf{K}_t \;=\; \mathbf{W}_t\, \mathbf{A}^-_t \quad : \qquad \begin{bmatrix} K_{1t} \\ K_{2t} \\ \vdots \\ K_{nt} \end{bmatrix} = \begin{bmatrix} w_{11t} & w_{12t} & \cdots & w_{n1t} \\ w_{21t} & w_{22t} & \cdots & w_{n2t} \\ \vdots & \vdots & \ddots & \vdots \\ w_{n1t} & w_{n2t} & \cdots & w_{nnt} \end{bmatrix} \begin{bmatrix} A^-_{1t} \\ A^-_{2t} \\ \vdots \\ A^-_{nt} \end{bmatrix} \tag{2.24}$$

Because the portfolio shares $\mathbf{W}_t$ depend on the rates of return vector $\mathbf{r}_t$, and the rate of return to capital in country i is monotonically decreasing in the capital stock K_{it}, finding an equilibrium consists in finding a vector of rates of return such that equation (2.24) holds.

2.6 Government Budget Constraint

The government collects revenues from two sources: accidental bequests of cohorts that died between $t-1$ and t, which we denote B_{jt} and the stochastic and deterministic wedges (ζ_{it} and τ_{ijt},respectively) which are akin to taxes on gross portfolio returns, $R^g_{it+1} = 1 + r_{it} - \delta_t$. Both of these revenues are transfered to the newly born cohort and the government budget constraint at time t is given by

$$T_{jt} = B_{jt} + \sum_{b<t} \left(\mathbf{w}'_{jbt} \left(\mathbf{R}_{jt} - \mathbf{R}^g_t \right) \right) A^-_{jbt-1} \tag{2.25}$$

Making use of the fact that all cohorts choose the same portfolio allocation and that the infinite number of cohorts eliminates the risk at the macroeconomic level, we show in Appendix B that this simplifies to

$$T_{jt} = B_{jt} + A^-_{jt-1} \sum_{j=1}^{n} w_{jt} \left(1 - \tau_{ijt}\right) r_{it}. \tag{2.26}$$

2.7 Revealed Capital Account Openness

Next, we impose some structure on the wedge τ_{ijt}, and introduce the concept of *Revealed Capital Account Openness* (RKO), which is our original approach to measuring the openness of a country's capital account. Analogous to Revealed Comparative Advantage (RCA) in international trade theory (Balassa, 1965; Koopman, Wang, and Wei, 2014), RKO gauges a country's openness based on observable investment patterns. Rather than relying on de jure measures or policy statements, RKO reveal the de facto openness of a country's capital account.

RKO is obtained by performing wedge-accounting on our model (as per Chari, Kehoe, and McGrattan, 2007). This approach is particularly useful because of the lack of comprehensive bilateral investment data dating back to the 1970s. The RKO wedges provide an economically-meaningful proxy for the openness of a country's capital account, allowing for the quantification of existing impediments to international investment.

We start by assuming that the RKO wedge (τ_{ijt}) can be decomposed as the product of an in-wedge τ^{in}_{it} – applied by the destination country – which captures the barriers to the incoming capital investment into country i, and an out-wedge τ^{out}_{jt} – applied by the origin country – which captures the barriers to the outgoing capital investment from country j. Formally:

$$\tau_{ijt} \;=\; \begin{cases} 1 & \text{if} \quad i = j \\ \tau^{\text{in}}_{it} \cdot \tau^{\text{out}}_{jt} & \text{if} \quad i \neq j \end{cases} \tag{2.27}$$

We call τ^{in}_{it} and τ^{out}_{jt} the *Inward* and *Outward* Revealed Capital Account Openness (RKO) of country j.

These wedges can be interpreted as summary statistics of all frictions that distort the international allocation of capital. As shown in the following proposition, without policy barriers to international investment, the equilibrium allocation is efficient in the sense that it maximizes GDP.

Proposition. *When $\beta_0 = 1$, (Gravity) full capital account openness ($\tau^{\text{in}}_{it} = \tau^{\text{out}}_{it} = 1 \;\forall\, i$) yields an allocation of capital across countries that maximizes world GDP at time t.*

Proof. Substituting inside equation (2.22), we obtain $w_{ijt} = r^{\beta_1}_{it} K_{it} / (\sum_{\iota=1}^{n} r^{\beta_1}_{\iota t} K^{\beta_0}_{\iota t})$. Because w_{ijt} does not depend on j, we have $w_{ijt} \propto K_{it}$. This in turn implies that the equation above simplifies to $r^{\beta_1}_{it} =$

$\sum_{\iota=1}^{n} r_{\iota t}^{\beta_1} w_{\iota jt}^{\beta_0}$, which doesn't depend on i. Hence, the rates of return to capital are equalized across countries, which is a necessary and sufficient condition for the maximization of world output (trivial). □

Consistent with the notion that the RKO wedges summarize the deviations from an efficient benchmark where capital is freely flowing and world GDP is maximized, the term $(1 - \tau_{it}^{\text{in}} \cdot \tau_{jt}^{\text{out}})$ can be interpreted as the implicit tax rate that an investor located in j has to pay on the return on an investment located in country i. We can thus interpret our RKO wedges as capturing *all* distortions that cause the world economy to deviate from the efficient allocation of the available capital across countries. While common de jure measures of capital account openness capture a narrow set of policies, our wedges are designed to capture all barriers to cross-border investment: institutions, taxation, capital controls, and so on.

3 Wedge Accounting and Identification

To quantify changes to barriers to international investment, we perform a wedge accounting exercise in the style of Chari, Kehoe, and McGrattan (2007). In this section, we show how to identify the barriers to international investment (τ_{ijt}), as well as the other exogenous variables of the model, including the saving rate (σ_{it}), the elasticity of output to natural resources, labor and capital (ξ_{it}, λ_{it},κ_{it}) and the depreciation rate (δ_t).

3.1 Identification of the RKO Wedges

We begin our analysis by showing how the wedges can be identified from moments of the data. If we observed bilateral investment positions, we could directly back out the wedges (τ_{ijt}) by using equation 2.22. But bilateral data exists for a large set of countries only for the most recent period. For example, the bilateral positions data from the IMF starts in the 2000s. We do not have bilateral investment positions for the full period under analysis.

We do have, however, the panel of the aggregate external asset and liability positions for each country as well as the panel of domestic portfolio shares. Let us call $\widetilde{K}_{it}$ the external liability position of country i, $\tilde{A}_{jt}^{-}$ the external asset position of country j and w_{jjt} the domestic portfolio share of country j:

$$\widetilde{K}_{it} \overset{\text{def}}{=} \sum_{j \neq i} A_{ijt} \;, \qquad \tilde{A}_{jt}^{-} \overset{\text{def}}{=} \sum_{i \neq j} A_{ijt}^{-} \qquad \text{and} \qquad w_{jjt} \overset{\text{def}}{=} \frac{A_{jjt}^{-}}{A_{jt}^{-}} \tag{3.1}$$

We can then identify total wealth (A_{jt}^{-}) and the share that is invested in domestic assets (w_{jjt}) as:

$$A_{jt}^{-} = K_{jt} + \tilde{A}_{jt}^{-} - \widetilde{K}_{jt} \qquad \text{and} \qquad w_{jjt} = \frac{K_{jt} - \widetilde{K}_{jt}}{A_{jt}^{-}} \tag{3.2}$$

Next, define the external portfolio share:

$$\tilde{w}_{ijt} \overset{\text{def}}{=} \frac{A_{jjt}}{\tilde{A}_{jt}^{-}} = \frac{\left(\tau_{it}^{\text{in}}\, r_{it}\right)^{\beta_1} K_{it}^{\beta_0}}{\sum_{\iota \neq i} \left(\tau_{\iota t}^{\text{in}}\, r_{it}\right)^{\beta_1} K_{\iota t}^{\beta_0}} \qquad \text{for } i \neq j \tag{3.3}$$

Notice that the term τ_{jt}^{out} has dropped out.

The external portfolio shares $\tilde{w}_{ijt}$ can be stacked in a square matrix $\widetilde{\mathbf{W}}_t$, and we can then write a variant of the capital markets clearing conditions (2.24), in terms of observables and the vector of in-wedges $\boldsymbol{\tau}_t^{\text{in}}$:

$$\widetilde{\mathbf{K}}_t \;=\; \widetilde{\mathbf{W}}_t(\boldsymbol{\tau}_t^{\text{in}}, \mathbf{r}_t, \widetilde{\mathbf{K}}_t) \cdot \tilde{\mathbf{A}}_t^{-} \tag{3.4}$$

We thus have a system of n identifying equations that can be used to identify the n-dimensional vector $\boldsymbol{\tau}_t^{\text{in}}$. Because the system is homogeneous of degree 1 in $\boldsymbol{\tau}_t^{\text{in}}$, this vector is only identified up to a constant.

This is however not a problem because the wedges $\tau_{it}^{\text{in}} \cdot \tau_{jt}^{\text{out}}$ are exactly identified. If we multiply the vector of $\boldsymbol{\tau}_{it}^{\text{in}}$ by a constant, it is offset by a division of the vector $\boldsymbol{\tau}_{jt}^{\text{out}}$ by the same factor. This rescaling doesn't affect our results. After discussing the identification of $\boldsymbol{\tau}_t^{\text{out}}$, we propose an intuitive normalization.

The reason why the capital markets clearing conditions identify the barriers impeding incoming flows of capital, $\boldsymbol{\tau}_t^{\text{in}}$, is intuitive: we infer that a country is characterized by high barriers to capital investment if its external liability is lower than what the model predicts given the observed external assets of all other countries and the model-implied portfolio share invested into this country.

The second step is to identify the out-wedges $\boldsymbol{\tau}_t^{\text{out}}$. By rewriting the domestic portfolio shares w_{jjt} as follows

$$w_{jjt} \;=\; \frac{r_{jt}^{\beta_1} K_{jt}^{\beta_0}}{r_{jt}^{\beta_1} K_{jt}^{\beta_0} + \sum_{\iota \neq j} (\tau_{\iota t}^{\text{in}}\, \tau_{jt}^{\text{out}}\, r_{\iota t})^{\beta_1} K_{\iota t}^{\beta_0}} \tag{3.5}$$

we can then rearrange and solve for the out-wedges in closed form:

$$\tau_{jt}^{\text{out}} \;=\; \left(\frac{1 - w_{jjt}}{w_{jjt}} \cdot \frac{r_{jt}^{\beta_1} K_{jt}^{\beta_0}}{\sum_{\iota \neq j} \left(\tau_{\iota t}^{\text{in}} r_{\iota t}\right)^{\beta_1} K_{\iota t}^{\beta_0}} \right)^{\frac{1}{\beta_1}} \tag{3.6}$$

The reason why the domestic portfolio shares identify the barriers impeding the outgoing flow of capital is also intuitive: a domestic portfolio share higher than what the model would predict given the observed returns implies high barriers to outgoing capital investment. Conversely, a higher propensity to invest abroad than the model predicts implies low barriers to outgoing investment.

Next, we propose a summary statistic of overall capital account openness, which we call the "World Capital Account Openness" (WKO), and which is equal to the GDP-weighted average of bilateral RKO wedges:

$$\tau_t^{w} \;\stackrel{\text{def}}{=}\; \sum_{i=1}^{n} \sum_{j=1}^{n} \frac{\bar{Y}_i\, \bar{Y}_j \cdot \tau_{it}^{\text{in}}\, \tau_{jt}^{\text{out}}}{\sum_{i'=1}^{n} \sum_{j'=1}^{n} \bar{Y}_{i'}\, \bar{Y}_{j'}} \tag{3.7}$$

where $\bar{Y}_i$ is the GDP of country i taken in a base year.[3] We can similarly define the following indices of inward and outward openness:

$$\bar{\tau}_t^{\text{in}} \;\stackrel{\text{def}}{=}\; \sum_{i=1}^{n} \frac{\bar{Y}_i \cdot \tau_{it}^{\text{in}}}{\sum_{i'=1}^{n} \bar{Y}_{i'}}; \qquad \bar{\tau}_t^{\text{out}} \;\stackrel{\text{def}}{=}\; \sum_{j=1}^{n} \frac{\bar{Y}_j \cdot \tau_{jt}^{\text{out}}}{\sum_{j'=1}^{n} \bar{Y}_{j'}} \tag{3.8}$$

An appealing property of these three indices is that, by construction, $\bar{\tau}_t^{\text{in}} \times \bar{\tau}_t^{\text{out}} \equiv \bar{\tau}_t^{w}$.

We can now go back to the problem of the normalization of $\boldsymbol{\tau}_t^{\text{in}}$, which we previously mentioned after equation (3.4). Intuitively, the reason why $\boldsymbol{\tau}_t^{\text{in}}$ is only identified up to a constant is that, in our model, a high degree

[3] Our weights are based on national GDP in 1995 but the method is robust to alternative weighing variables.

of world outward openness is observationally equivalent to a high degree of world inward openness. For this reason, it is natural to normalize $\boldsymbol{\tau}_{it}^{\text{in}}$ and $\boldsymbol{\tau}_{jt}^{\text{out}}$ so that:

$$\bar{\tau}_t^{\text{in}} \equiv \bar{\tau}_t^{\text{out}} \equiv \sqrt{\tau_t^w} \tag{3.9}$$

3.2 Recovering the Other Unobserved Variables

Because $\boldsymbol{\tau}_{it}^{\text{in}}$ and $\boldsymbol{\tau}_{jt}^{\text{out}}$ are identified by perfectly fitting the portfolio shares $\mathbf{W}_t$, by identifying these two objects we also identify the equilibrium portfolio shares. Next, we show how to recover the unobserved time-varying variables in our model.

The residual income $\mathcal{E}_{it}$ is obtained by inverting the household's budget constraint:

$$\mathcal{E}_{jt} = C_{jt} + A_{jt}^{-} - P_{jt}^{L} L_{jt} - P_{jt}^{X} X_{jt} - A_{jt}^{+} \tag{3.10}$$

We cannot identify natural resources separately from TFP, because we do not have measures of the natural capital stock. However, this does not pose a challenge to our measurement exercise, since we only need to identify $\Omega_{it} X_{it}^{\xi_{it}}$. This in turn can be easily recovered from the production function (equation 2.1), whose elasticities we estimated in the previous step:

$$\Omega_{it} X_{it}^{\xi_{it}} = \frac{Y_{it}}{K_{it}^{\kappa_{it}} L_{it}^{\lambda_{it}}}. \tag{3.11}$$

The path of adjusted discount factor σ_{jt} is pinned down by the path of saving rates, s_{jt}, given by equation (2.14):

$$\sigma_{jt} = \frac{A_{jt}^{-}}{A_{jt}^{+} + \mathcal{T}_{jT} + P_{jt}^{L} L_{jt} + P_{jt}^{X} X_{jt} + \mathcal{E}_{jt}}. \tag{3.12}$$

4 Data and Calibration

4.1 Data Sources

The Penn World Tables (version 10) are our data source for the following variables: number of employees[4] (L_{it}), the real capital stock measured in constant prices (K_{it}), the labor compensation share $\left(\lambda_{it} \equiv P_{it}^{L} L_{it}/Y_{it}\right)$, real output measured in PPP at constant prices (Y_{it}), consumption (C_{it}) and the rate of depreciation of capital (δ_t).

The panel of total external assets and liabilities is provided by the Wealth of Nations dataset constructed by Lane and Milesi-Ferretti (2018). Because in our model capital is homogeneous, we deflate all countries' capital stocks and external assets and liabilities using a common deflator to ensure that capital stocks and external positions are measured in the same units.[5]

[4] For our model, it does not matter whether we use human capital-adjusted employment or simple employed persons. This choice only shifts that measured total factor productivity (z) but it does not affect the results of the counterfactual.

[5] If we deflated capital with the PWT country-specific deflator, we wouldn't be able to compare capital stocks to external positions, since deriving deflators for external assets and liabilities positions require knowledge of the entire matrix of bilateral positions between countries.

The natural resources rent share $\left(\xi_{it} \equiv P_{it}^X X_{it}/Y_{it}\right)$ data comes from the World Bank database "The Changing Wealth of Nations 2018." Following the methodology of Monge-Naranjo et al. (2019), we avoid on purpose measuring the natural resources share using data on stocks of natural capital, opting instead to use natural resources rent payments as a percentage of GDP. The World Bank estimates these using the annual production of several natural commodities, evaluated at current prices.

4.2 Coverage

In order to estimate our model, we require a balanced panel of countries for which the implied domestic investment is always positive i.e. we require that $A_{jt}^- \geq \widetilde{A}_{jt}^-$ and $K_{jt} \geq \widetilde{K}_{jt}$. Our baseline sample contains a total of 58 countries, covering nearly 70% of the world GDP in 2019. The full list of countries is available in Appendix A. This list excludes Russia and China, for which no data is available before the 1990s. We make sure that our results are not driven by the selected nature of this sample, by repeating all of our analyses with a wider but shorter balanced panel of countries, which coves 94 countries, accounts for about 90% of the world GDP, and starts in 1993.

4.3 Calibration of Free Parameters

We need to calibrate two free parameters, the elasticities of portfolio shares with respect to the destination country's size, β_0, and with respect to the rate of return to capital, β_1. We start by calibrating the elasticity with respect to size to 1 for two reasons. Using a dataset of bilateral cross-border flows between 14 countries, Portes and Rey (2005) find that the elasticity of investment with respect to country size is very close to unity and never statistically different from 1 in all of their specifications. In addition, another appealing feature of calibrating this parameter to 1 is that the RKO wedges correspond to deviations from an efficient allocation of capital as shown in proposition 2.7.

We then calibrate the elasticity of portfolio shares with respect to the rate of return to capital - β_1. Consistent with PSW, we set it equal to 1 as well for the following reasons. Koijen and Yogo (2020) estimate a demand system for international assets and find demand-return semi-elasticities of 42 and 10.5 for short-term and long-term securities and a demand-price elasticity of 1.9 for equity. To convert the former into the elasticity to returns, we multiply 42 and 10.5 by the average interest rates, 3.6% for long-term and 1.8% for short-term securities, respectively. Averaging across both asset classes gives an elasticity of 0.85. To convert the elasticity of equity demand to price, we use the Gordon dividend growth model to obtain the elasticity of demand to return and multiply 1.9 by the rate of returns of equity minus their growth rate divided by one plus the rate of returns. We use the average MSCI world returns of 9.3% and a growth rate of world output of 2.9%, and obtain an elasticity of 1.3. It is thus natural to set β_1 equal to 1.

5 Validation

In this section, we validate our RKO wedges (τ_{ij}) by showing that they are tightly related to several barriers to cross-border investment – namely: (1) capital account restrictions in the origin country and (2) in the destination country; (3) taxation of returns on investment; and (4) political risk. Although we do not see our analysis as providing a causal identification of the drivers, it provides empirical support (in additional to the theoretical one) for our interpretation of our wedges as measures of *de facto* capital account openness.

Table 1: Correlation of the RKO Wedges with External Measures

Wedge	**Predictor**	**Source**	**Correlation** (ρ)
$\sqrt{\tau_{it}^{\text{in}}\,\tau_{it}^{\text{out}}}$	Capital Account Openness	Chinn and Ito (2008)	0.40***
τ_{it}^{out}	Outward Capital Controls	Fernández et al. (2015)	-0.10*
τ_{it}^{in}	Inward Capital Controls	Fernández et al. (2015)	-0.41***
τ_{it}^{in}	Political Risk Safety	ICRG	0.61***
τ_{it}^{in}	Tax Rate on External Capital	Pellegrino et al. (2021)	-0.31**

TABLE NOTES:***p-value$<$ 0.01;**p-value$<$ 0.05;*p-value$<$ 0.1. p-values use country-clustered standard errors (except for Tax Rate on External Capital, which is a purely cross-sectional variable).

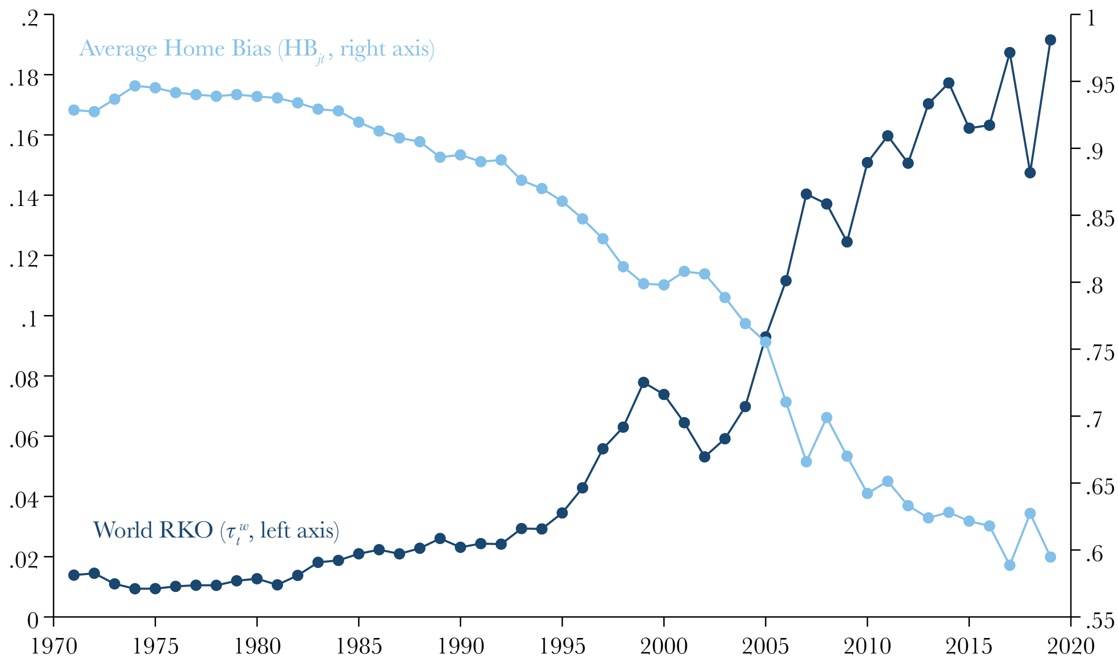
To begin, we use two widely-used measures of *de jure* capital account openness – all derived from the IMF's Annual Report on Exchange Arrangements and Exchange Restrictions (AREAR) database, which documents country-level policy measures that affect international capital flows. The first is from Chinn and Ito (2008, CI) and the second is from Fernández et al. (2015, FKRSU).[6] While CI provides only a single index at the country level capturing both restrictions on inflows and outflows, the second dataset has a separate measure for inward and outward restrictions. When we use this second dataset, we therefore correlate our measure of outward wedges with their index of outward capital control in the origin country and our measure of inward wedges with the index on inward restrictions in the destination country.

We also use the Political Risk Score, published by the International Country Risk Guide (ICRG), which combines information on risk of expropriation, of payment delays and risk regarding profits repatriation.The ICRG dataset covers 137 countries since 1984.

Finally, we use a measure of the tax rate on external capital in the destination country, which is constructed in a similar way as the country-level composite tax rate on capital in Pellegrino et al. (2021). It is obtained by combining corporate tax rates from KPMG (and supplemented by the Tax Foundation database) with withholding tax rates on dividend and interest income by the IBFD. We weight the taxes rates on equity (corporate income and dividends) and debt (interest) using the equity and debt share of the country's foreign liabilities from Lane and Milesi-Ferretti (2018).[7]

For each of the five variables, we find that the estimated correlations are large in absolute value (0.36 on average) and have the expected sign. They are also statistically significant, with p-values below 1%, except for taxation ($1\% < p < 5\%$) and outward capital controls ($5\% < p < 10\%$).

Figure 1: World Capital Account Openness



6 Measuring Financial Globalization

6.1 World Capital Account Openness

We start our empirical analysis by confirming, using our World RKO measure, τ_t^w, that the global economy has experienced a tremendous increase in capital account openness and that the implicit tax rate on capital income facing a typical international investor has decreased significantly over the past five decades. Figure 1 plots the evolution from 1971 to 2019 of our RKO measures τ_t^w (darker line, plotted on the left axis). We also plot, on the right axis (lighter line), a measure of home bias in international investment. Following Coeurdacier and Rey (2013), home bias for country j is defined as:

$$\text{HB}_{jt} \overset{\text{def}}{=} 1 - (1 - w_{jjt}) \frac{\sum_{i=1}^{n} K_{it}}{\sum_{i' \neq j} K_{i't}}. \tag{6.1}$$

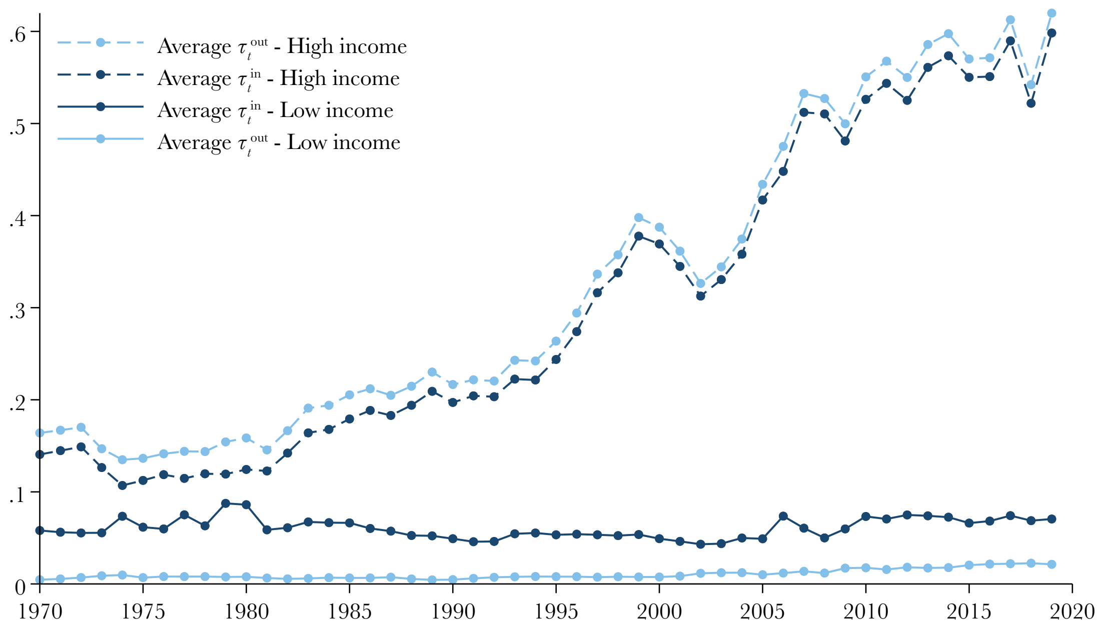
By construction, this measure is equal to one when all of j's wealth is invested in domestic assets, and is equal to zero when the share invested in domestic assets equals j's share of the world capital stock. For Figure 1, we compute the cross-country average by weighting countries according to their PPP$ GDP in 1995.

The first thing we notice from the figure is that τ_i^w was about .02 in 1971, implying that restrictions on incoming investment by the destination country and on outgoing investment from the origin country, have the combined equivalent effect of a 98% tax on returns. World financial markets were practically in a state of

[6] Our results are robust to using measures of capital controls from Jahan and Wang (2016, JW).

[7] The difference between our measure and that of PSW (and the reason why it's called tax rate on *external* capital) is that PSW use weights 4/5 and 1/5 based on domestic US data.

Figure 2: Revealed Capital Account Openness, High vs. Low Income Countries



autarky. After 1980, World RKO have progressively increased to reach almost .2 in 2019, which corresponds to an implicit income tax on international investment returns of 80%.

One manifestation of this increased openness in the capital account is the declining skew of country portfolios towards domestic assets: home bias declines, over these five decades, from 0.93 in 1971 to 0.59 in 2019.[8]

This increase in the World RKO is consistent with another well-known measure of de facto financial globalization: the sum of external assets and liabilities over GDP. As mentioned in the introduction, the latter has increased from 50% in 1971 to 300% in 2019. Similarly, the ratio of total external liabilities relative to the world capital stock has increased from about 5% in 1971 to about 60% in 2019.

6.2 Heterogeneity (Unbalanced Financial Globalization)

We now turn to the cross-country dispersion of our RKO wedges, and its evolution over the last five decades. We highlight the striking finding that financial globalization has been *unbalanced*, in the sense that the increase in world capital account openness documented above has been driven disproportionately by high-income countries. To show this, we split countries in our sample between low-income countries, and high-income countries, using as a threshold PPP GDP/capita of $25,000 in 1995. With this classification, there are 41 countries in the low-income group (denoted L) and 17 in the high-income group (denoted H); the latter account for 70% of the world's GDP in 1995. We then compute the weighted average of inward and outward openness, where each country is weighted by its 1995 real GDP and we report the results in Figure 2.

We can see that, in the early 1970s, high-income countries were already more financially open than low-income countries, both inwardly as well as outwardly. More importantly, this gap has widened dramatically since then. The implicit tax rate on outflows and inflows in high-income countries has decreased by about

[8]Using alternative weights in the computation of the average does not alter this result.

40 percentage points (from over 80% to just above 40%) over the past 50 years. Over the same period, the implicit tax on outflows from low-income countries has decreased by only a couple of percentage points, and the tax on inflows has essentially stagnated. This asymmetry turns out to have major implications for efficiency, the spatial allocation of investments and factor prices. This is the focus of the next section.

7 Counterfactual Analysis

Having documented the unbalanced nature of financial globalization, what can we say about its implications for the real economy? In this section, we use the model and RKO wedges to assess the implications for world output, cross-country inequality and the remuneration of labor and capital. Specifically, we compare two equilibrium paths. The first equilibrium path corresponds to the estimated RKO wedges and perfectly matches the observed time series of GDP, income, capital, external positions, etc... The second is the counterfactual equilibrium path of the model where the RKO wedges are held constant at their value in 1971 for all subsequent years. This equilibrium simulates a path of the world economy where financial globalization did not take place: we refer to it as "no financial globalization" scenario.

Both equilibria share the same exogenous paths of labor supply (L_{it}), natural resources (X_{it}), factor compensation shares $(\kappa_{it}, \lambda_{it}, \xi_{it})$, total factor productivity (Ω_{it}) and patience parameters (σ_{jt}). Changing the RKO wedges endogenously affects the paths of wealth $\left(A_{it}^{-}\right)$, capital stocks (K_{it}) and portfolio shares $(\mathbf{W}_t)$, which in turn alters the paths of output (Y_{it}), consumption (C_{it}), wages $\left(P_{it}^{L}\right)$, the rental rate of natural resources $\left(P_{it}^{X}\right)$ and, the rates of return (r_{it}). By definition, the two economies are identical in 1971.

The lines corresponding to the "Unbalanced" scenario in Table 2 present the value of world GDP and the cross-country variance of the log of GDP per capita, relative to the "No-Globalization" scenario (for which the values are indexed to 100 for every period). It also presents similar figures for capital per employee, real wage (labor compensation per employee) and returns to capital, splitting the sample into low and high-income countries. In other words, for each variable/year, the table presents the ratio of that variable to its counterpart in the No-Globalization scenario. We present these numbers for three equidistant years, 1971, 1995 and 2019. To compute these summary statistics we weight countries by their 1995 PPP$ GDP $\left(\bar{Y}\right)$.

In addition, the table presents two additional scenarios, *Symmetric* and *Convergent*. These are discussed later on in the section.

7.1 Capital Allocation Efficiency

The first result we obtain from the counterfactual simulation is that financial globalization had an adverse effect on the efficiency of capital allocation − that is, world GDP is lower in 2019 than it would have been, had financial globalization not occurred. This can be easily seen in the first line of Table 2, which displays the percentage difference in world output between the (actually observed) "unbalanced globalization" scenario and the "no financial globalization" scenario. Quantitatively, the effects are significant: world output is 1.4% lower today than in a world in which the wedges τ_{ijt} had remained constant. In addition, comparing the figures for 1995 and 2019, it is clear that the unbalanced patterns of globalization didn't lead to output losses until the last two decades of the sample.

This finding contrasts sharply with traditional models of capital markets integration in which the removal of barriers to foreign investment leads investors to invest in capital-scarce countries where returns are high, and

Table 2: Counterfactual Analysis (No-Globalization Scenario = 100)

Statistic	Scenario	1971	1995	2019
World GDP	Unbalanced*	100	100.38	98.62
$= \sum_{i=1}^{n} Y_{it}$	Symmetric	100	101.68	109.45
	Convergent	100	105.14	136.13
Variance of log GDP/Capita	Unbalanced*	100	101.51	109.83
$= \text{var}_{i\in \text{H}\cup \text{L}} \left[\log\left(Y_{it}/\text{pop}_{it}\right)\right]$	Symmetric	100	95.22	65.16
	Convergent	100	94.13	70.16
Capital/Employee - High Income C.	Unbalanced*	100	100.78	105.96
$= \text{mean}_{i\in \text{H}} \left(K_{it}/L_{it}\right)$	Symmetric	100	98.33	63.30
	Convergent	100	99.09	53.27
Capital/Employee - Low Income C.	Unbalanced*	100	99.94	92.68
$= \text{mean}_{i\in \text{L}} \left(K_{it}/L_{it}\right)$	Symmetric	100	106.62	161.21
	Convergent	100	109.60	318.26
Real Wage - High Income Countries	Unbalanced*	100	100.85	103.30
$= \text{mean}_{i\in \text{H}} \left(P^{L}_{it}\right)$	Symmetric	100	100.06	80.57
	Convergent	100	101.92	77.84
Real Wage - Low Income Countries	Unbalanced*	100	99.32	95.40
$= \text{mean}_{i\in \text{L}} \left(P^{L}_{it}\right)$	Symmetric	100	104.43	123.98
	Convergent	100	110.83	195.87
Return on Capital - High Income C.	Unbalanced*	100	82.80	87.22
$= \text{mean}_{i\in \text{H}} \left(r_{it}\right)$	Symmetric	100	94.17	130.38
	Convergent	100	80.89	136.14
Return on Capital - Low Income C.	Unbalanced*	100	102.26	106.92
$= \text{mean}_{i\in \text{L}} \left(r_{it}\right)$	Symmetric	100	93.08	79.62
	Convergent	100	85.25	61.61
Return on Portfolio - High Income C.	Unbalanced*	100	101.63	101.79
$= \text{mean}_{j\in \text{H}} \left(\mathbf{w}'_{jt}\,\mathbf{r}_t\right)$	Symmetric	100	97.65	130.86
	Convergent	100	94.39	145.42
Return on Portfolio - Low Income C.	Unbalanced*	100	96.37	93.23
$= \text{mean}_{j\in \text{L}} \left(\mathbf{w}'_{jt}\,\mathbf{r}_t\right)$	Symmetric	100	93.05	79.37
	Convergent	100	85.16	61.80

TABLE NOTES: *refers to the equilibrium actually observed in the data. All figures are relative to the No-Globalization scenario. All summary statistics are weighted by 1995 real GDP $(\bar{Y})$. H and L denote, respectively, the sets of high and low-income countries (1995 PPPGDP per capita above/below $25,000).

capital to migrate from capital-rich to capital-poor countries. This is the traditional argument in favor of free mobility of capital.

To better understand this seemingly counterintuitive result, it is useful to examine the lines of Table 2 that present the evolution of capital per employee and the rate of return on capital. While financial globalization has led to an increase in the stock of capital per capita in high-income countries, with a 5.6% increase relative to the no-globalization world. This boost in the capital stock of richer countries has been at the expense of a lower capital stock low-income countries, for which the level is 14.5% lower than in the counterfactual. Unbalanced financial globalization has reallocated capital from capital-scarce to capital-rich countries. At the same time, we have seen an exacerbation of the differences in the returns on capital: with respect to the no-globalization scenario, the rate of return on capital is 8.8% lower in high-income countries, and 11.1% higher in low-income ones.

These facts provide an intuitive explanation for how uneven financial integration exacerbated the misallocation of capital. When a set of countries unilaterally lowers barriers to international investment, it improves foreign investors' perceived return on its own capital stock, thus attracting investment. Whether the allocation of capital improves or worsens depends on whether capital was already misallocated towards these countries at the inception of the policy change. If the countries that opened their capital account already had "too much" capital to begin with, the policy change leads to an exacerbation of capital inequality and capital returns differential, thus leading to further misallocation.

As we has shown in the previous section, this is clearly what happened with high-income countries in the context of our model. Unbalanced financial globalization led to an "upstream" reallocation of capital: from capital-scarce, high-MPK, low-income countries to capital-rich, low-MPK, high-income countries.

7.2 Cross-country Inequality

A second implication of our model is that unbalanced financial globalization led to an increase in inequality of output per capita across countries. The line "Variance of log GDP per capita" in Table 2 shows the effect of unbalanced financial globalization on cross-country income dispersion. Relative to a counterfactual world without globalization, inequality, as measured by the variance of log GDP per capita, has been 1.5% higher in 1995 and 9.8% higher in 2019. In sum, our analysis indicates that the globalization of financial markets has exacerbated income differences across countries.

Through the lens of a traditional model of financial integration, this result is equally counterintuitive. However, it can again be rationalized by looking at relative changes in the capital stock per employee. Because capital is the only movable factor in our model, capital markets integration affects GDP per capita only by affecting the relative scarcity of capital across countries. In our model, unbalanced financial globalization further increased the capital stock of high-income, capital-rich countries and further depressed that of capital-scarce, low-income countries, thus exacerbating not only capital misallocation, but also pre-existing income gaps across countries.

7.3 Factor Remuneration

Next, we show that unbalanced financial globalization led to unexpected changes in the relative price of factors of production in each country, thus affecting the distribution income between workers and the owners of capital.

As shown in Table 2, in high-income countries wages are 3.3% higher, and the rate of return on capital is 12.8% lower in 2019 relative to the no-globalization scenario. The increase in wages is the natural consequence of the higher marginal product of labor resulting from higher capital-labor ratios. Despite the decline in the marginal product of capital domestically, the return on portfolio is 1.8% higher, as globalization has made it easier for investors in high-income countries to invest in developing countries (where the returns on capital are higher).

These findings again contrast with the canonical view that financial globalization has worsened the conditions of workers and benefited capital-owners in high-income countries (*e.g.* Stiglitz, 2012). This view is based on the implicit assumption that countries liberalize their capital accounts at similar paces; as we shall see in the next section, under such conditions, capital indeed migrates from high-income to poor countries, lowering the marginal product of labor (and thus wages) in rich countries. This assumption is clearly not supported by our RKO wedges. While we share the view that capital-owners in high-income countries have benefited from increased investment opportunities, we also find that wage earners in high-income countries has benefited from the upstream reallocation of capital.

In low-income countries, wages are 4.6% lower in 2019 than in the no-globalization scenario, which reflects the decrease in the capital-labor ratio. It is striking to see that financial globalization has further exacerbated inequality across workers located in rich and poor countries, which confirms the results that it has increased the variance of GDP per employee. The return on capital is 6.9% higher in low-income countries due to globalization in 2019, but the return on portfolios is 6.8% lower. This divergence reflects the fact that barriers to investment into high-income countries have declined much faster, which has made it appealing for investors located in low-income countries to allocate a bigger share of their portfolios in assets located in high-income countries despite the lower rate of return they offer.

7.4 Balanced Financial Globalization and Policy Implications

A central argument in favor of capital account liberalization is that capital gets allocated to countries where returns are higher, thus boosting global output and reducing cross-country inequality. In the previous section, we argued that the disparate manner in which this process unfolded resulted in a rather different outcome. In this section, we extend our counterfactual analysis, demonstrating that the unbalanced nature of financial globalization is indeed the cause of these unexpected results. We support our argument by constructing two additional "balanced" globalization scenarios: in the first, countries increase their capital account openness symmetrically; in the second, they achieve convergence.

To construct these two scenarios, we use our World RKO (τ_t^w) index as a point of reference, in the sense that this summary statistic of global openness will be the same as in the baseline scenario.

In the first scenario, which we call *Symmetric*, all countries decrease their barriers to outward and inward investment at the same pace. Keeping the World RKO path unchanged, we construct the counterfactual RKO wedges for this scenario (τ_{ijt}^{sym}) as follows:

$$\tau_{ijt}^{\text{sym}} \overset{\text{def}}{=} \tau_{ij,1970} \cdot \frac{\tau_t^w}{\tau_{j,1970}^w} \qquad \text{for } i \neq j \tag{7.1}$$

When countries open up symmetrically, their initial differences in capital account openness persist over time, and as result low-income countries, which were already less open than high-income countries in the 1970s, remain so until 2019. In addition, in this scenario, significant barriers to investment remain in 2019 on average, as discussed in section 6.

In our second balanced financial globalization scenario, which we call *Convergent,* all heterogeneity in inward and outward openness is progressively removed by 2019, while keeping the World RKO path unchanged. Specifically, we assume that the path of RKO wedges is given by

$$\log \tau_{ijt}^{\text{con}} \quad \stackrel{\text{def}}{=} \quad \frac{2019-t}{49} \cdot \log \tau_{ijt}^{\text{sym}} + \frac{t-1970}{49} \cdot \log \tau_t^w \qquad \text{for } i \neq j \tag{7.2}$$

which implies that the bilateral wedges τ_{ijt} are all equal to τ_t^w in 2019 (except for $i=j$, obviously).

As before, both counterfactual scenarios share the same paths of all other exogenous variables (L_{it}, X_{it}, κ_{it}, λ_{it}, ξ_{it}, Ω_{it}, σ_{jt}) as the baseline one and the model endogenously generates the paths of the following variables:A_{it}^- , K_{it} , w_{ijt}, Y_{it}, $P_{it}^{L;}$, P_{it}^X, r_{it}, and $\bar{r}_{it}$. By definition, all four economies are identical in 1970. The results are reported in the lines “Symmetric” and “Convergent” in Table 2 and all variables are relative to the no-financial globalization scenario.

Our results confirm the idea that financial globalization didn’t have to lead to a worsening of the capital allocation and cross-country inequality. In both these counterfactual scenarios, financial globalization would have, in fact, led to the exact opposite outcome. In 2019, world output would have been 9.5% higher in the “symmetric” scenario and 36.1% higher in the convergent scenario.

In both these counterfactuals, capital undergoes a massive reallocation from capital-rich to capital-poor countries. In low-income countries, the capital stock per employee increases, in 2019, by 61.2% in the “symmetric” scenario and 218.3% in the “convergent” scenario; wages increase by 24% and 96%, respectively. For rich countries, we observe the exact opposite: capital/employee decreases by 36.6% and 46.6%; wages decrease by 20% and 22%, respectively. Cross-country inequality, measured as the variance of log GDP per capita, would have been 34.8% lower in the “symmetric” scenario and 43.7% lower in the “convergent” scenario, relative to the no-globalization scenario.

8 Robustness Analysis

In this section, we investigate the robustness of our previous findings to three concerns. First the country coverage of our sample, second the fact that governments bonds are included and third the model specification for the households savings.

8.1 A Shorter Panel with More Countries

Although the set of 58 countries included in our baseline analysis covers 70% of global GDP in 2019, one concern is that missing the remaining 30% of the world economy may bias our results. We address this concern by broadening the set of countries included in the analysis and to address the data limitations, we restrict the sample period to the last three decades and start our analysis in 1993. Our shorter panel contains 94 countries, which accounts for X% of world GDP, and the full list of countries is given in Appendix in Table 5.

Our previous findings remain broadly unchanged, as shown in Table 4 in Appendix. On the implications for capital efficiency, we find that the world output is 2.4% lower today than in a world in which the wedges

τ_{ijt} had remained constant—which is larger that the 1.4% found in our baseline results. The increase in the dispersion of income per capita across countries (+9.7%) is almost exactly the same as in our main findings (+9.8%). We also find very similar results for the capital to output ratios and the factor remunerations.

8.2 Government Flows

The literature has documented the important role played by sovereign-to-sovereign transactions in accounting for upstream capital flows and the allocation puzzle (Gourinchas and Jeanne, 2013; Alfaro et al., 2014). To address the concern that our results may be in part shaped by sovereign financial flows, we would ideally exclude governments' international assets and liabilities from the Wealth of Nations dataset. Unfortunately this dataset doesn't break down assets and liabilities by public and private agents and it difficult to find other data sources with information on government international positions with a global coverage. The main dataset used in the literature on sovereign flows, the World Bank's *International Debt Statistics Database* (the successor of *Global Development Finance*), covers only developing countries which is too limited a sample for our global approach.[9]

Instead we take advantage of the fact that the Wealth of Nations dataset breaks down assets and liabilities by financial instruments (equity, bonds, FDI, other) and that an overwhelming share of government debt is in bonds, by excluding a fraction of bonds from the liabilities of all countries. To calibrate this fraction, we compute the share of government bonds in total foreign bonds holdings in the portfolios of investors located in the U.S.. We find that, on average, 45% of bonds are government bonds. We assume this fraction is the same across countries, and to ensure consistency of global bonds liabilities and assets, we also remove this fraction from the holdings of bonds on the asset side of all countries.

We find that our counterfactual results are robust, albeit quantitatively smaller, as shown in Table 6. The world output is 0.7% lower today than in a world in which the wedges τ_{ijt} had remained constant, and the dispersion of income per capital across countries is 7.3% higher. We also find very similar results for the capital to output ratios and the factor remunerations. The quantitatively smaller effects support the idea that government flows matter to some extent. However, they account only for a small fraction of the difference with the symmetric and convergent scenarios: in 2019, world output would have been 6.5% higher in the "symmetric" scenario and 35.2% higher in the convergent scenario (9.5% and 36.1% respectively, in the baseline).

8.3 Alternative Microfoundations of the Saving Rate

Our microfoundation for the saving rate builds on two well-known consumption-saving models: the perpetual youth and the capitalist-worker models. One advantage of this specification is that it delivers analytical solutions for the aggregate saving rate which we can then easily map to our country-year-level dataset to estimate the sequence of time preference parameters in each country.

A second advantage is that it implies that the path of aggregate saving rates remains unchanged across the three scenarios we investigate. This allows us to isolate the role played by the reallocation of international portfolios. Our results are thus robust to any alternative models that feature an *aggregate* saving rate that is exogenous to frictions to international investments. In a previous version of this paper, we showed that a

[9] This dataset is also one of the underlying sources used by Alfaro et al. (2014) to construct their dataset of net private and public capital flows.

model with an infinitely-lived agent with wealth in the utility shares this property, which implies that all our results exactly go through in this alternative microfoundation.

While our baseline approach holds the aggregate saving rate $\left(\frac{A^-_{jt}}{A^+_{jt}+P^L_{jt}L_{jt}+P^X_{jt}X_{jt}+T_{jt}+\mathcal{E}_{jt}}\right)$ unchanged across scenarios, we have also investigated a capitalist-worker version of the model in which only capitalists save, which implies constant savings *as a share of gross capital income*, $\left(s_{jt} = \frac{A^-_{jt}}{A^+_{jt}}\right)$. The details of the model and the quantitative results are shown in Appendix E. All our previous findings remain broadly unchanged: the world output is 2.8% lower today than in a world in which the wedges τ_{ijt} had remained constant—which is twice as large as the 1.4% found in our baseline results—and the dispersion of income per capita across countries is 12.2% higher (compared to 9.8% in our baseline results). We also find very similar results for the capital to output ratios and the factor remunerations.

9 Conclusions

In this study, we contributed the following three novel insights to the literature on international capital markets integration and capital allocation. First, we have developed a new multi-country model of international investment and production, and proposed new measures of Revealed Capital Account Openness, which are based on a wedge-accounting exercise. We validated our RKO measures, showing that they correlate strongly with various de-jure measures of international investment frictions.

Second, we used our RKO wedges to document a stylized fact that that we call *Unbalanced Financial Globalization*: while there has been an overall dramatic increase in de-facto capital account openness, this increase occurred at highly-heterogenous paces in different countries. High-income countries have liberalized their capital account much more than poorer countries.

Third, we used our model to distill the implications of this unbalanced financial globalization on the world output, cross-country inequality, and the cross-section of wages and capital rents. We found that it led to diametrically opposite effects with respect to what would be predicted by more canonical models of financial markets integration: a worsening of the global allocation of capital, more extreme cross-country inequality, relatively higher wages and lower returns to capital in high-income countries with respect to poor countries. Further counterfactual analysis confirms the central role played by country heterogeneity in determining these outcomes.

Our key innovation with respect to the existing literature is to provide a rigorous theoretical and empirical treatment of country heterogeneity, and to show how accounting for this heterogeneity can have dramatic repercussions on what we infer from the data about the real effects of international capital markets integration.

The conclusions of this paper open up avenues for future research. First, more work is needed to shed light on the reasons why countries have opened at different pace, to what extent this de-facto openness is the result of deliberate policy decisions, and whether these policy decisions may have been optimal responses to the international economic environment. Second, our counterfactual analysis holds exogenous (although not constant) a few factors that shape the redistributive implications of financial globalization and that might also be affected by it, such as the labor shares and the saving rates. For example, labor shares could vary endogenously if the technology displays more substitution than we assumed; or if wages are not determined competitively but through bargaining and bargaining power itself depends on the degree of openness. We believe these are important avenues for future research.

These findings suggest important policy implications. While the international organizations' recommendations take into account each country's characteristics including financial market development and investment safety in the sequence and pace of capital account policy reform, our findings highlight that a more even (and perhaps convergent) path of capital account opening would have led to a more desirable and efficient distribution of capital. For financial integration to deliver on its promises, there is therefore an important role for further coordination across countries.

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Unbalanced Financial Globalization - Online Appendix

Damien Capelle and Bruno Pellegrino

A Additional Tables and Figures

Table 3: List of Countries in the Long Panel

ARG	Argentina	JAM	Jamaica
AUS	Australia	JOR	Jordan
AUT	Austria	JPN	Japan
BOL	Bolivia	KEN	Kenya
BRA	Brazil	LKA	Sri Lanka
BRB	Barbados	MAR	Morocco
CAN	Canada	MEX	Mexico
CHL	Chile	MYS	Malaysia
CIV	Côte d'Ivoire	NER	Niger
CMR	Cameroon	NGA	Nigeria
COL	Colombia	NOR	Norway
CRI	Costa Rica	NZL	New Zealand
DEU	Germany	PER	Peru
DNK	Denmark	PHL	Philippines
DOM	Dominican Republic	PRY	Paraguay
ECU	Ecuador	QAT	Qatar
EGY	Egypt	RWA	Rwanda
ESP	Spain	SAU	Saudi Arabia
FIN	Finland	SEN	Senegal
FRA	France	SWE	Sweden
GAB	Gabon	TCD	Chad
GRC	Greece	THA	Thailand
GTM	Guatemala	TUN	Tunisia
HND	Honduras	TUR	Turkey
IDN	Indonesia	TZA	Tanzania
IND	India	URY	Uruguay
IRN	Iran	USA	United States
ISR	Israel	ZAF	South Africa
ITA	Italy	ZMB	Zambia

B Model Solution

B.1 Optimal Saving

We start from equation 2.6

$$V_{jbt} \stackrel{\text{def}}{=} (1-\sigma_{jt})\log C_{jbt} + \sigma_{jt}\,\mathbb{E}_{jt}\left(V_{jbt+1}\right) \tag{B.1}$$

and we guess that there exists two time and country specific (but common to all cohorts) variables η_{1jt} and η_{0jt} such that $V_{jbt} = \eta_{1jt}\log(A^{+}_{jbt}) + \eta_{0jt}$.In addition, we denote the saving rate at time t as s_{jbt}. With these notations, substituting in the previous expression for cohorts born before the current period $b < t$, we obtain :

$$\begin{aligned}
\eta_{1jt}\log(A^{+}_{jbt}) + \eta_{0jt} &= \max_{s_{jbt},\mathbf{w}_{jbt+1}\in\Delta^n} (1-\sigma_{jt})\log(1-s_{jbt})A^{+}_{jbt} \\
&\quad + \sigma_{jt}\,\mathbb{E}_{jt}\left(\eta_{1jt+1}\log(A^{+}_{jbt+1}) + \eta_{0jt+1}\right) \\
\eta_{1jt}\log(A^{+}_{jbt}) + \eta_{0jt} &= \max_{s_{jbt},\mathbf{w}_{jbt+1}\in\Delta^n} (1-\sigma_{jt})\log(1-s_{jbt})A^{+}_{jbt} \\
&\quad + \sigma_{jt}\ \mathbb{E}_{jt}\left(\eta_{1jt+1}\log\left(\left(\mathbf{w}'_{jbt+1}\mathbf{R}_{jt+1}\right)\cdot s_{jbt}A^{+}_{jbt}\right) + \eta_{0jt+1}\right)
\end{aligned}$$

Identifying all the terms in $\log(A^{+}_{jbt})$ it must be the case that

$$\eta_{1jt} = (1-\sigma_{jt}) + \sigma_{jt}\,\eta_{1jt+1}$$

and

$$\begin{aligned}
\eta_{0jt} &= \max_{s'_{jbt}} (1-\sigma_{jt})\log(1-s_{jbt}) + \sigma_{jt}\,\eta_{1jt+1}\log\left(s_{jbt}\right) \\
&\quad + \sigma_{jt}\,\eta_{1jt+1}\max_{\mathbf{w}_{jbt+1}\in\Delta^n}\mathbb{E}_{jt}\log\left(\mathbf{w}'_{jbt+1}\mathbf{R}_{jt+1}\right) + \sigma_{jt}\,\eta_{0jt+1}
\end{aligned}$$

Importantly the decision about how much to save s_{jbt} is independent of the decision about how to allocate the portfolio shares $\mathbf{w}_{jbt+1}$. We can thus solve these two problems separately. Iterating forward the former condition, we find that η_{1t} is equal to 1 at all periods:

$$\eta_{1jt} = (1-\sigma_{jt}) + \sum_{t'=t}^{\infty}\prod_{t''=t}^{t'}\sigma_{jt''}\ \left(1-\sigma_{jt''+1}\right) = 1$$

Using this finding and taking the first order condition with respect to the saving rate, we obtain

$$\frac{1-\sigma_{jt}}{1-s_{jbt}} = \frac{\sigma_{jt}}{s_{jbt}}$$
$$s_{jbt} = \sigma_{jt}$$

An important implication is that the saving rate is common to all cohorts, $s_{jbt} = s_{jt}$.

Following KY, we solve the portfolio problem in the main text. There, we find that the portfolio shares are common to all cohorts. Therefore this confirms that η_{0jt} is common across all cohorts and independent of b.

Recall that we had assumed that $t > b$. For the newly born agents, it is easy to show that the same results hold. The only difference is that newly born agents start with income $P^L_{jbt}L_{jbt} + P^X_{jbt}X_{jbt} + T_{jbt} + \mathcal{E}_{jbt}$. If we denote $A^+_{jbb} = P^L_{jbt}L_{jbt} + P^X_{jbt}X_{jbt} + T_{jbt} + \mathcal{E}_{jbt}$ it is straightforward to check that we obtain the same saving rule as above if we take the first-order condition with respect to the saving rate in the following problem

$$\begin{aligned}\eta_{1jt}\log(A^+_{jbb}) + \eta_{0jt} \quad &= \max_{s_{jbt},\mathbf{w}_{jbt+1}\in\Delta^n} (1-\sigma_{jt})\log(1-s_{jbb})A^+_{jbb} \\ &\quad + \sigma_{jt}\ \mathbb{E}_{jt}\left(\eta_{1jt+1}\log(A^+_{jbt+1}) + \eta_{0jt+1}\right).\end{aligned}$$

B.2 Absence of Macroeconomic Risk

In this section, we show that the aggregate beginning of period wealth is not stochastic despite the fact individuals portfolios are due to the stochastic wedge ζ_{jbt}.

$$\begin{aligned}\sum_{b<t}\left(\mathbf{w}'_{jbt}\mathbf{R}_{jt}\right)A^-_{jbt-1} &= \sum_{b<t}\sum_{j=1}^{n} w_{jbt}\zeta_{ibt}\left(1+\tau_{ijt}r_{it}-\delta_t\right)A^-_{jbt-1} \\ &= A^-_{jt-1}\sum_{j=1}^{n} w_{jt}\left(1+\tau_{ijt}r_{it}-\delta_t\right)\sum_{b<t}\zeta_{ibt}a^-_{jbt-1}\end{aligned}$$

where we denote $a^-_{jbt-1} = \frac{A^-_{jbt-1}}{A^-_{jt-1}}$ the fraction of national wealth owned by cohort b and the second line uses the fact that all cohorts have the same portfolio.

We next show that for a set of shares a^-_{jbt-1} the sum $\sum_{b<t}\zeta_{ibt}a^-_{jbt-1}$ is not stochastic. Given that ζ_{ibt} is i.i.d. across cohorts we have the following

$$\begin{aligned}Var\left(\sum_{t'\leq b<t}\zeta_{ibt}a^-_{jbt-1}\right) &= Var(\zeta_{ibt})\sqrt{\sum_{t'\leq b<t}\left(a^-_{jbt-1}\right)^2} \\ &\leq Var(\zeta_{ibt})\sqrt{\frac{1}{t-t'}}\end{aligned}$$

Letting t' go to $-\infty$ gives $Var\left(\sum_{b<t}\zeta_{ibt}a^{-}_{jbt-1}\right) = 0$. Hence the sum $\sum_{b<t}\zeta_{ibt}a^{-}_{jbt-1}$ is almost surely equal to its expectation, $\sum_{b<t}\zeta_{ibt}a^{-}_{jbt-1} \overset{a.s}{=} 1$.

Hence we obtain

$$\sum_{b<t}\left(\mathbf{w}'_{jbt}\mathbf{R}_{jt}\right)A^{-}_{jbt-1} = A^{-}_{jt-1}\sum_{j=1}^{n} w_{jt}\left(1+\tau_{ijt}r_{it}-\delta_t\right).$$

B.3 Government Transfers

From the previous finding, we can simplify the second part of the transfers to the newly born cohort:

$$\sum_{b<t}\left(\mathbf{w}'_{jbt}\left(\mathbf{R}_{jt}-\mathbf{R}^{n}_{t}\right)\right)A^{-}_{jbt-1} = A^{-}_{jt-1}\sum_{j=1}^{n} w_{jt}\left(1-\tau_{ijt}\right)r_{it} \quad \text{(B.2)}$$

C Results with Short Panel

In this appendix we reproduce Figures 1-2 and Tables 2-3, using the short panel (95 countries, 1993-2019), instead of the long panel (58 countries, 1971-2019).

Figure 3: World Capital Account Openness

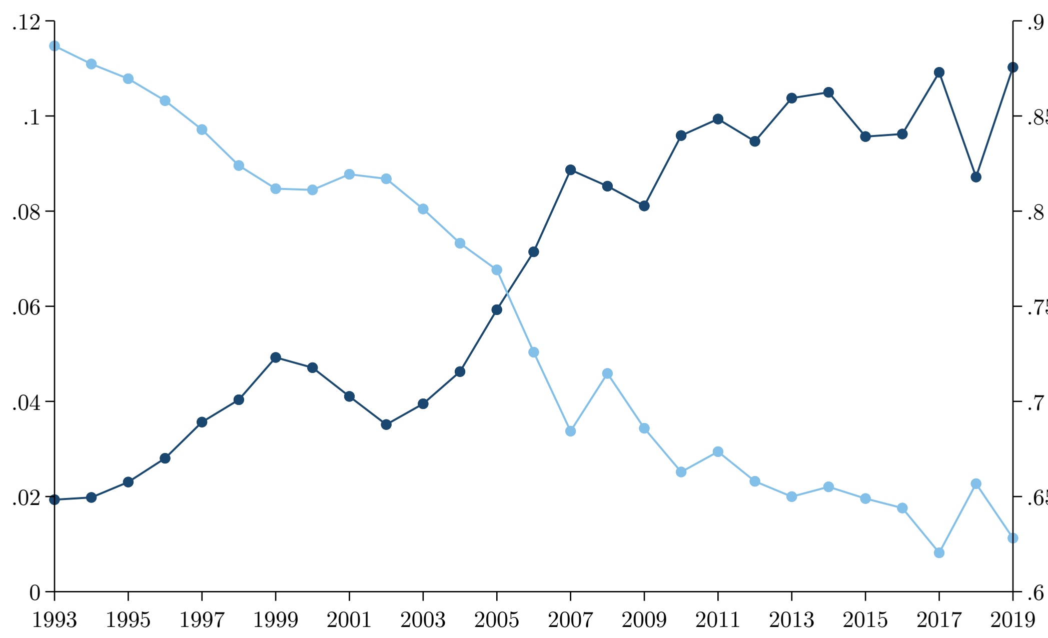

Figure 4: Revealed Capital Account Openness, High vs. Low Income Countries

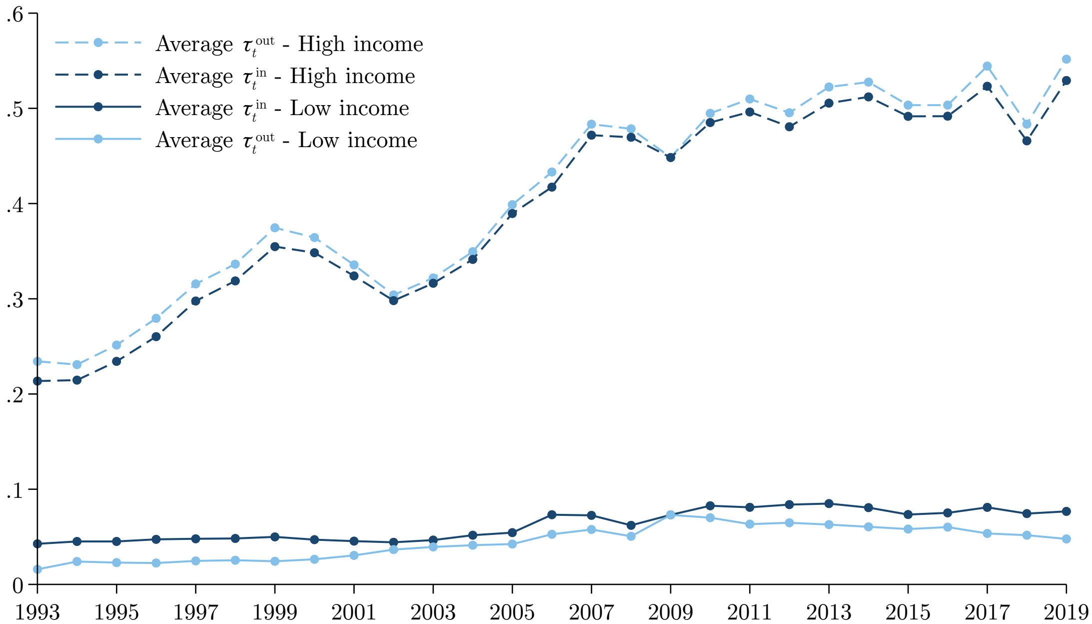

Table 4: Counterfactual Analysis (No-Globalization Scenario = 100)

Statistic	**Scenario**	1993	2019
World GDP	Unbalanced*	100	97.62
$= \sum_{i=1}^{n} Y_{it}$	Symmetric	100	104.25
	Convergent	100	122.90
Variance of log GDP/Capita	Unbalanced*	100	109.72
$= \text{var}_{i \in \text{H} \cup \text{L}} \left[\log\left(Y_{it}/\text{pop}_{it}\right)\right]$	Symmetric	100	81.84
	Convergent	100	74.31
Capital/Employee - High Income C.	Unbalanced*	100	108.07
$= \text{mean}_{i \in \text{H}} \left(K_{it}/L_{it}\right)$	Symmetric	100	83.86
	Convergent	100	56.04
Capital/Employee - Low Income C.	Unbalanced*	100	93.86
$= \text{mean}_{i \in \text{L}} \left(K_{it}/L_{it}\right)$	Symmetric	100	111.89
	Convergent	100	162.70
Real Wage - High Income Countries	Unbalanced*	100	103.57
$= \text{mean}_{i \in \text{H}} \left(P_{it}^{L}\right)$	Symmetric	100	92.60
	Convergent	100	78.62
Real Wage - Low Income Countries	Unbalanced*	100	97.10
$= \text{mean}_{i \in \text{L}} \left(P_{it}^{L}\right)$	Symmetric	100	106.49
	Convergent	100	138.33
Return on Capital - High Income C.	Unbalanced*	100	98.00
$= \text{mean}_{i \in \text{H}} \left(r_{it}\right)$	Symmetric	100	115.13
	Convergent	100	153.58
Return on Capital - Low Income C.	Unbalanced*	100	104.57
$= \text{mean}_{i \in \text{L}} \left(r_{it}\right)$	Symmetric	100	90.90
	Convergent	100	73.84
Return on Portfolio - High Income C.	Unbalanced*	100	101.86
$= \text{mean}_{j \in \text{H}} \left(\mathbf{w}_{jt}' \, \mathbf{r}_t\right)$	Symmetric	100	108.91
	Convergent	100	145.11
Return on Portfolio - Low Income C.	Unbalanced*	100	94.41
$= \text{mean}_{j \in \text{L}} \left(\mathbf{w}_{jt}' \, \mathbf{r}_t\right)$	Symmetric	100	91.28
	Convergent	100	75.23

TABLE NOTES: *refers to the equilibrium actually observed in the data. All figures are relative to the No-Globalization scenario. All summary statistics are weighted by 1995 real GDP $\left(\bar{Y}\right)$. H and L denote, respectively, the sets of high and low-income countries (1995 PPPGDP per capita above/below $25,000).

Table 5: List of Countries in the Short Panel

AGO	Angola	GRC	Greece	OMN	Oman
ARG	Argentina	GTM	Guatemala	PAN	Panama
AUS	Australia	HND	Honduras	PER	Peru
AUT	Austria	HUN	Hungary	PHL	Philippines
BEN	Benin	IDN	Indonesia	POL	Poland
BFA	Burkina Faso	IND	India	PRT	Portugal
BGR	Bulgaria	IRN	Iran	PRY	Paraguay
BOL	Bolivia	ISR	Israel	QAT	Qatar
BRA	Brazil	ITA	Italy	ROU	Romania
BRB	Barbados	JAM	Jamaica	RUS	Russia
BWA	Botswana	JOR	Jordan	RWA	Rwanda
CAF	Central African Rep.	JPN	Japan	SAU	Saudi Arabia
CAN	Canada	KEN	Kenya	SEN	Senegal
CHL	Chile	KGZ	Kyrgyz Republic	STP	Sao Tome and Principe
CHN	China	KOR	South Korea	SUR	Suriname
CIV	Cote d'Ivoire	KWT	Kuwait	SVK	Slovak Republic
CMR	Cameroon	LKA	Sri Lanka	SVN	Slovenia
COL	Colombia	LSO	Lesotho	SWE	Sweden
CPV	Cape Verde	LTU	Lithuania	SWZ	Swaziland
CRI	Costa Rica	LVA	Latvia	TCD	Chad
CZE	Czech Republic	MAR	Morocco	TGO	Togo
DEU	Germany	MEX	Mexico	THA	Thailand
DJI	Djibouti	MKD	Macedonia	TUN	Tunisia
DNK	Denmark	MNG	Mongolia	TUR	Turkey
DOM	Dominican Rep.	MRT	Mauritania	TZA	Tanzania
ECU	Ecuador	MYS	Malaysia	URY	Uruguay
EGY	Egypt	NAM	Namibia	USA	United States
ESP	Spain	NER	Niger	UZB	Uzbekistan
EST	Estonia	NGA	Nigeria	ZAF	South Africa
FJI	Fiji	NIC	Nicaragua	ZMB	Zambia
FRA	France	NOR	Norway		
GAB	Gabon	NZL	New Zealand		

D Results Without "Sovereign Flows"(Data Excluding 45% of Bond Positions)

In this appendix we reproduce Figures 1-2 and Tables 2-3 using an alternative dataset where we removed 45% of the bond assets, to correct for the presence of government bonds in our dataset.

Figure 5: World Capital Account Openness

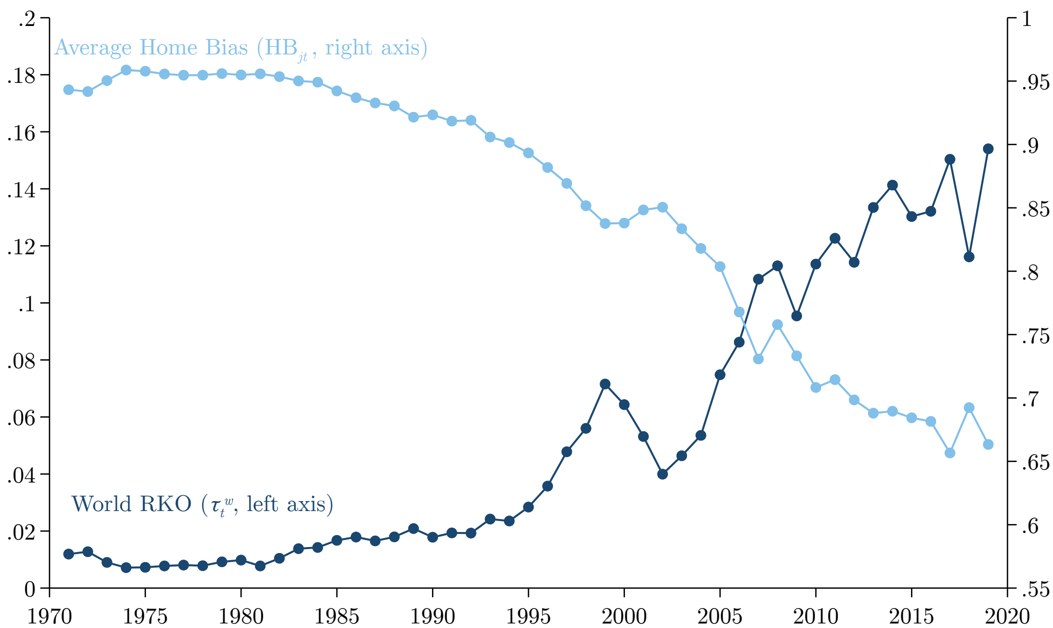

Figure 6: Revealed Capital Account Openness, High vs. Low Income Countries

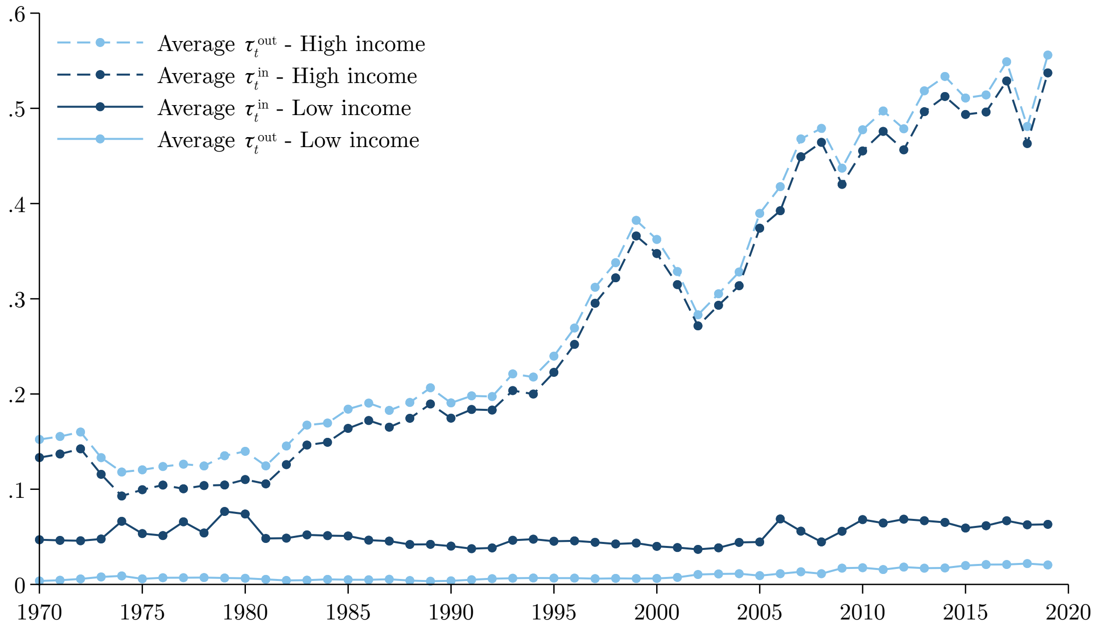

Table 6: Counterfactual Analysis (No-Globalization Scenario = 100)

Statistic	Scenario	1971	1995	2019
World GDP	Unbalanced*	100	100.34	99.23
$= \sum_{i=1}^{n} Y_{it}$	Symmetric	100	101.02	106.53
	Convergent	100	103.78	135.23
Variance of log GDP/Capita	Unbalanced*	100	101.18	107.31
$= \text{var}_{i \in \text{H} \cup \text{L}} [\log (Y_{it}/\text{pop}_{it})]$	Symmetric	100	97.12	69.14
	Convergent	100	96.86	71.31
Capital/Employee - High Income C.	Unbalanced*	100	100.55	104.98
$= \text{mean}_{i \in \text{H}} (K_{it}/L_{it})$	Symmetric	100	99.03	69.78
	Convergent	100	100.23	56.77
Capital/Employee - Low Income C.	Unbalanced*	100	99.99	94.78
$= \text{mean}_{i \in \text{L}} (K_{it}/L_{it})$	Symmetric	100	103.74	149.88
	Convergent	100	102.69	304.55
Real Wage - High Income Countries	Unbalanced*	100	100.63	102.63
$= \text{mean}_{i \in \text{H}} (P_{it}^{L})$	Symmetric	100	100.10	84.52
	Convergent	100	102.04	79.46
Real Wage - Low Income Countries	Unbalanced*	100	99.62	96.75
$= \text{mean}_{i \in \text{L}} (P_{it}^{L})$	Symmetric	100	102.63	118.71
	Convergent	100	106.48	192.05
Return on Capital - High Income C.	Unbalanced*	100	87.75	92.16
$= \text{mean}_{i \in \text{H}} (r_{it})$	Symmetric	100	97.83	124.58
	Convergent	100	85.38	139.81
Return on Capital - Low Income C.	Unbalanced*	100	101.52	104.42
$= \text{mean}_{i \in \text{L}} (r_{it})$	Symmetric	100	95.68	82.14
	Convergent	100	89.10	61.85
Return on Portfolio - High Income C.	Unbalanced*	100	101.43	103.21
$= \text{mean}_{j \in \text{H}} \left(\mathbf{w}_{jt}' \, \mathbf{r}_t \right)$	Symmetric	100	98.48	123.98
	Convergent	100	94.18	144.87
Return on Portfolio - Low Income C.	Unbalanced*	100	97.10	92.90
$= \text{mean}_{j \in \text{L}} \left(\mathbf{w}_{jt}' \, \mathbf{r}_t \right)$	Symmetric	100	95.67	82.05
	Convergent	100	89.00	61.95

TABLE NOTES: *refers to the equilibrium actually observed in the data. All figures are relative to the No-Globalization scenario. All summary statistics are weighted by 1995 real GDP $(\bar{Y})$. H and L denote, respectively, the sets of high and low-income countries (1995 PPPGDP per capita above/below $25,000).

E Model with Capitalists and Workers

In this appendix, we show that our baseline results in Table 4 are robust to a specification of the model in which capitalists and workers are both infinitely lived but separate agents. Assume there are two types of agents, workers and capitalists, and we index these two types with $\theta = \{W, K\}$. Utility of both types of agents is given by

$$V_{jt}^{\theta} = (1-\sigma_{jt}) \log C_{jt}^{\theta} + \sigma_{jt} \cdot \mathbb{E}_t \left(V_{jt+1}^{\theta} \right) \tag{E.1}$$

Workers earn income from labor that is supplied inelastically and transfers from the government, which are equal to tax revenues and rents from natural resources. As it is common in the literature, workers are hand-to-mouth and consume their current income:

$$C_{jt}^{W} = P_{jt}^{L} L_{jt} + P_{jt}^{X} X_{jt} + T_{jt} + \mathcal{E}_{jt} \tag{E.2}$$

Capitalists own all the capital and, each period earn the returns on their portfolio

$$A_{jt+1}^{+} = \left(\mathbf{w}_{t+1}' \mathbf{R}_{t+1} \right) A_{jt}^{-} \tag{E.3}$$

and choose how much to withdraw from it and to consume

$$C_{jt}^{K} = A_{jt}^{+} - A_{jt}^{-} = (1-s_{jt}) A_{jt}^{+} = (1-s_{jt}) \left(\mathbf{w}_t' \mathbf{R}_t \right) A_{jt-1}^{-} = (1-s_{jt}) \left(\mathbf{w}_t' \mathbf{R}_t \right) s_{jt-1} A_{jt-1}^{+} \tag{E.4}$$

where s_{jt} denotes the saving rates of capitalists at time t and country j. The following table, which gives the results of the counterfactuals done in the workers-capitalists version of the model, confirms that our results are robust.

Table 7: Counterfactual Analysis (No-Globalization Scenario = 100)

Statistic	Scenario	1971	1995	2019
World GDP	Unbalanced*	100	100.13	97.19
$= \sum_{i=1}^{n} Y_{it}$	Symmetric	100	101.14	104.56
	Convergent	100	103.33	138.43
Variance of log GDP/Capita	Unbalanced*	100	102.15	112.18
$= \text{var}_{i \in \text{H} \cup \text{L}} \left[\log\left(Y_{it}/\text{pop}_{it}\right)\right]$	Symmetric	100	96.66	75.38
	Convergent	100	95.85	69.01
Capital/Employee - High Income C.	Unbalanced*	100	100.78	105.57
$= \text{mean}_{i \in \text{H}} \left(K_{it}/L_{it}\right)$	Symmetric	100	98.56	71.87
	Convergent	100	98.35	56.27
Capital/Employee - Low Income C.	Unbalanced*	100	98.46	85.48
$= \text{mean}_{i \in \text{L}} \left(K_{it}/L_{it}\right)$	Symmetric	100	104.09	137.78
	Convergent	100	103.47	319.87
Real Wage - High Income Countries	Unbalanced*	100	100.88	102.67
$= \text{mean}_{i \in \text{H}} \left(P_{it}^{L}\right)$	Symmetric	100	100.08	85.68
	Convergent	100	101.32	79.67
Real Wage - Low Income Countries	Unbalanced*	100	98.33	91.06
$= \text{mean}_{i \in \text{L}} \left(P_{it}^{L}\right)$	Symmetric	100	102.84	113.22
	Convergent	100	106.35	195.2
Return on Capital - High Income C.	Unbalanced*	100	82.24	91.24
$= \text{mean}_{i \in \text{H}} \left(r_{it}\right)$	Symmetric	100	96.22	121.29
	Convergent	100	84.74	132.86
Return on Capital - Low Income C.	Unbalanced*	100	103.73	111.15
$= \text{mean}_{i \in \text{L}} \left(r_{it}\right)$	Symmetric	100	95.27	87.07
	Convergent	100	89.39	61.64
Return on Portfolio - High Income C.	Unbalanced*	100	101.42	102.49
$= \text{mean}_{j \in \text{H}} \left(\mathbf{w}_{jt}' \, \mathbf{r}_t\right)$	Symmetric	100	97.99	120.03
	Convergent	100	95.23	136.66
Return on Portfolio - Low Income C.	Unbalanced*	100	97.64	96.76
$= \text{mean}_{j \in \text{L}} \left(\mathbf{w}_{jt}' \, \mathbf{r}_t\right)$	Symmetric	100	95.23	86.93
	Convergent	100	89.3	61.76

TABLE NOTES: *refers to the equilibrium actually observed in the data. All figures are relative to the No-Globalization scenario. All summary statistics are weighted by 1995 real GDP $\left(\bar{Y}\right)$. H and L denote, respectively, the sets of high and low-income countries (1995 PPPGDP per capita above/below $25,000).