Winners and losers from reducing global imbalances *

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Abstract

We highlight the welfare effect of policies that balance global current accounts in the face of uninsurable income risk and borrowing constraints. Subsidizing savings in debtor economies reduces imbalances and raises the welfare of almost all citizens by increasing world-wide capital, raising wages, and improving insurance for low-wealth households. However, the same balancing of current accounts is achieved by taxing savings in lender economies, but hurts most households by reducing capital. We conclude that balancing global imbalances should not be a goal unto itself, but may be a by-product of raising investment rates, especially in debtor countries.

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1 Introduction

After international financial markets were liberalized during the 1970's and early 1980's, global imbalances between lender and debtor economies increased. Some countries have now accumulated an enormous amount of foreign-held debt: as the the world's largest net debtor, the United States owed over 50% of annual GDP to foreign borrowers in 2019.

The magnitude and persistence of global imbalances have attracted substantial attention from both policymakers and academics. Some argue that these imbalances are undesirable and should be reduced because they originated for "bad" reasons, such as distortions that have caused high savings and low investment in lender economies or credit booms in debtor economies fueled by "poor" government policies rather than by fundamentals. Others worry that imbalances may eventually have "bad" consequences, such as a sudden-stop resulting in costly readjustment (Obstfeld, 2004; Obstfeld and Rogoff, 2007; Blanchard and Milesi-Ferretti, 2012). Proponents of balancing the current accounts between debtor and lender economies focus on two types of policies, either (1) increasing national savings by debtors or (2) reducing savings in countries that run large current account surpluses (Triggs, 2019).

In this paper we examine the effects of these two policies using the U.S. as a concrete example of a debtor-economy, since it has the largest amount of foreign-held debt relative to GDP. We use a two-country version of a Bewley-Imrohoroglu-Huggett-Aiyagari (BIHA) economy (Aiyagari, 1994) with heterogeneous households and uninsurable idiosyncratic risk, similar to Mendoza et al. (2009b) and Kabukçuoğlu (2017). Within this framework we examine how effective these policies are in reducing imbalances, what the impact of each policy would be on the wealth distribution within each country, and how the welfare effects of each policy would be distributed within each country.

First, we find that financial integration leads foreigners to invest in the United States, which raises physical capital. This increases wages and reduces the return on capital. The net effect is an increase in welfare for almost all Americans relative to financial autarky, with only the wealthiest households suffering welfare losses from lower rental rates. Of course, this leads to an outflow of capital from foreign economies, which lowers their wage, raises their return on capital, and has the opposite welfare effects for low- versus high-wealth households.

Nevertheless, welfare is almost universally higher in a world with open financial markets than one with complete autarky.

We then consider two policies that reduce the U.S. current account deficit without returning the world to financial autarky. The first is a savings subsidy in the United States that increases the return on savings for Americans. A higher return on savings increases the amount of U.S. capital that is financed domestically, which lowers foreigners' return from lending to the United States. This policy leads to higher total capital in both the United States and the rest of the world, progressively raising wages and welfare.[1] The second policy is a tax on capital income abroad, which reduces the U.S. current account deficit as well as U.S. capital. Less capital reduces the welfare of all Americans except for those with the highest wealth, who enjoy higher returns.[2] We conclude that balancing capital accounts is not a beneficial policy in and of itself, but may raise welfare if it increases productive capital in debtor-economies.

1.1 Relation to the Literature

Our paper bridges work on savings incentives in incomplete markets models and policies to balance current accounts. Our paper is most similar to Mendoza, Quadrini and Ríos-Rull (Mendoza et al. (2009a, 2007)) who study the welfare effects of opening global financial markets with incomplete markets. However, their models do not have a pecuniary externality of financing capital with foreign debt through wages, which is a central feature of our model.[3] Our result that subsidizing the savings of Americans can raise both U.S. and foreign welfare through a pecuniary externality on wages quantitatively complements the finding by Dávila,

[1] It is striking that the welfare effects are progressive because we assume that the subsidy on capital returns is financed with lump sum taxes, which are regressive on their own. Low-income households would gain more if the subsidy was financed with progressive income taxes rather than lump sum.

[2] There is substantial evidence that the savings margin is the main driver of the current account imbalances (Chamon and Prasad, 2010; Steinberg, 2019). We add an additional piece to that evidence by documenting that the cross-country variation in savings rates far exceeds the cross-country variation in investment rates.

[3] Mendoza, Quadrini, and Ríos-Rull (Mendoza et al. (2009a)) assume that rental rates depend on aggregate capital but wages are exogenous, and Mendoza and others (Mendoza et al. (2007)) assume that each household operates a production technology that determines both their return on capital and wage, but these are independent of the investment decisions of all other households. Therefore, neither feature a pecuniary externality of aggregate capital on aggregate wages.

Hong, Krussell, and Ríos-Rull (Dávila et al. (2012))'s finding that capital is inefficiently low in a realistic calibration of the U.S. economy.[4]

We also contribute to the literature on capital account imbalances. Earlier studies focused on the question of sustainability of a persistent external deficit in the U.S. (Cooper, 2001; Obstfeld and Rogoff, 2007), mechanisms responsible for its emergence (Caballero et al., 2008; Mendoza et al., 2009b; Chien and Naknoi, 2015), consequences for the U.S. economy (Kehoe et al., 2018; Reyes-Heroles, 2018), or potential ways to eliminate or reduce it (Obstfeld, 2004; İmrohoroğlu and Zhao, 2018). Our main focus is not on *how* rebalancing is achieved. Instead, we force rebalancing to happen (via two different policies), and then analyze how costs and benefits of these policies are distributed across households. This method connects to a somewhat small literature on the consequences of rebalancing. Kehoe et al. (2013) show that if rebalancing occurs gradually, the impact on the U.S. economy would be very small, while a sudden stop of lending to the U.S. would be extremely disruptive. To the best of our knowledge, our study is the first to address the distributional welfare consequences of rebalancing in a BIHA economy.[5]

Although global imbalances occur because some countries save more than they invest and others do the opposite, our analysis focuses on the savings aspect. This is motivated by several convincing studies that argue that the savings channel is the driving force behind imbalances. For example, (Broer, 2014) focuses on very low savings rates in the United States and (Chamon and Prasad, 2010), (Michaud and Rothert, 2014), and (Steinberg, 2019) focus on very high savings rates in the lender countries. We provide additional evidence that variation in savings rates between debtor and creditor countries far exceeds the variation in investment rates.

[4]We assume that lump-sum transfers are a small piece of the public insurance policy and that are not changed independently when policy makers attempt to balance the current account. As shown by Dyrda and Pedroni (2022), raising transfers significantly can better insure low-wealth workers against shocks than raising wages through further capital accumulation.

[5]Our model highlights how policies that balance current accounts affect households who face uninsurable income shocks. This is distinct from Liu et al. (2023), who focus on how current account policies can affect permanent income heterogeneity through capital-skill complementarities but abstract from the transitory income risk.

2 Global imbalances since 1980

We start by documenting three important stylized facts about the magnitude of net external positions, persistence of current account imbalances, and the relative role played by savings and investment margins. Our data on net foreign asset positions, current account balances and nominal GDP is from Lane and Milesi-Ferretti (2018), updated in December 2021[6]. We merge it with the National Income and Product Accounts statistics from the World Bank's World Development Indicators (WDI).

Magnitude Figure 1 illustrates the growth of imbalances in net foreign asset positions since the early 1980s. The first panel depicts the GDP-weighted average of absolute values of net foreign asset positions has been steadily growing and its most recent value is the highest one on record. The second and third panels present the growing imbalance of the net foreign asset positions (relative to GDP) in the largest debtor (USA) and the largest creditor country (Japan). In short, in terms of magnitude, global imbalances appear to be alive and well.

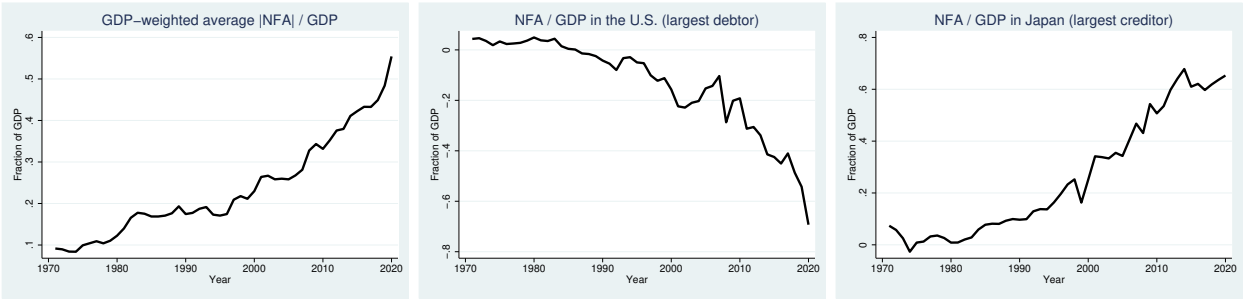

Figure 1: Global imbalances

Notes: Net Foreign Asset positions (NFA) and GDP are in nominal U.S. dollars, as reported in Lane and Milesi-Ferretti (2018).

While some studies express worries about the magnitude of external imbalances, there is no clear guidance from quantitative economic models about the magnitude that would or would not be sustainable. When looked at from the perspective of the neo-classical small

[6]Available at: https://www.brookings.edu/research/the-external-wealth-of-nations-database/

open economy model, the observed magnitudes of either current account or net foreign asset surpluses and deficits are actually quite small (Gourinchas and Jeanne, 2013; Rothert, 2016; Rothert and Short, 2023). In a richer, two-country framework, Mendoza et al. (2009b) showed the imbalances of the early 2000's were fully in line with long-run external solvency of the deficit economies.

Persistence The steady increase in net external debt of the U.S. is a result of a persistent deficit of its current account — $CA \equiv \Delta NFA$. Figure 2 shows that the persistence of the current account surplus or deficit is a common feature among the largest debtor and creditor countries. It plots the current account balances of three groups of countries: those that during the period 1995-2005 were among the world's top 10 surplus economies, top 10 deficit economies, and the rest of the world. The persistence is evident — the top 10 surplus economies from the 1995-2005 are still running a sizeable current account surplus, whereas the top 10 deficit economies from the 1995-2005 are still running a sizeable current account deficit.

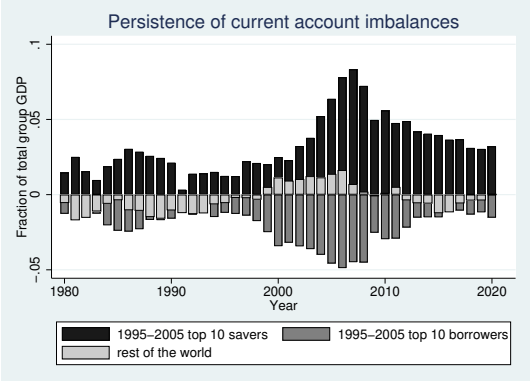

Figure 2: Current account surpluses and deficits

Notes: Top ten savers/borrowers are defined as countries with the largest (in absolute terms) cumulative current account surplus/deficit over the period 1995-2005. The top ten savers were: Switzerland, United Arab Emirates, Norway, Hong Kong, Saudi Arabia, Japan, China, Kuwait, Singapore, Germany. The top ten borrowers were: Spain, United States, Portugal, Australia, Mexico, Italy, Brazil, Greece, Turkey, Korea.

Savings vs. Investment Next, we look at the relative role of savings and investment margins in driving the cross-country differences in their current account imbalances. The basic national income accounting identity tells us that the current account is the difference between national savings and national investment expenditures:

$$CA = S - I.$$

A country may have a current account surplus because households or government agencies save a lot, or because businesses invest very little (conversely for deficit). Figure 3 suggests that it is the difference in savings behavior across countries that is responsible for the cross-country differences in current account balances and, subsequently, the accumulated net foreign debt or surplus. We put countries in two groups. Borrowers are countries that during the period 2010-2019 have increased their net foreign debt, while lenders are countries that during the same period have decreased their net foreign debt. Within each group we computed the (unweighted) average saving and investment rate across countries. The investment rates are almost identical between these two groups, whereas the difference in the average savings rate is very large - about 15% among borrowers and more than 30% among lenders.

3 Model

Our quantitative model is a two-country version of the classic heterogeneous agent-incomplete markets framework of Aiyagari (1994), similar to Mendoza et al. (2007, 2009b) and Kabukçuoğlu (2017). However, we first analyze a toy-model to illustrate the mechanisms through which increasing savings in a debtor-economy can improve welfare.

3.1 Two-period model of debtor economy

In order to build intuition, we first study a two-period economy with a measure μ of households who can save and earn income from interest (i.e. capitalists) and a measure $1-\mu$ who are hand-to-mouth and earn wages (i.e. workers). The wage and interest rate are determined endogenously through the marginal products of capital and labor in the second period, while

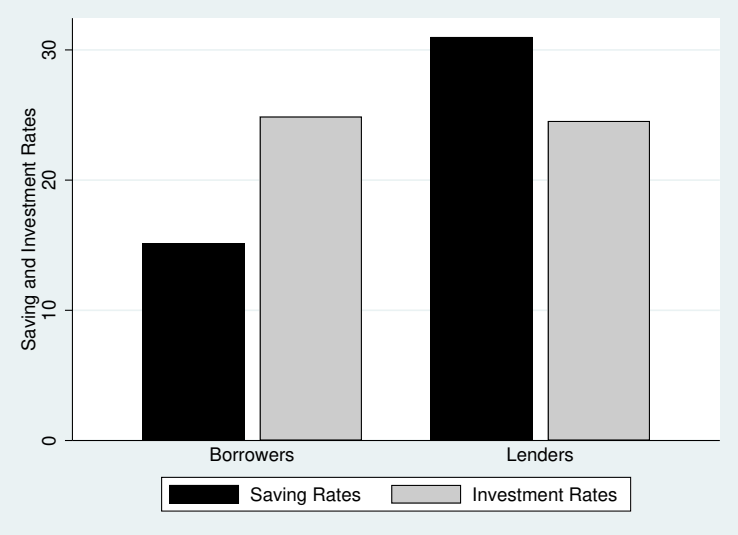

Figure 3: Savings vs. Investment as the drivers of Current Account balances

Notes: Borrowers/lenders are defined as countries with the cumulative current account deficit/surplus over the period 2010-2019. See Appendix A for the list of countries in each group. Investment rate ≡ gross capital formation / GDP (both nominal U.S. local currency units). Saving rate ≡ (GDP - C - G)/GDP (all nominal). Simple averages within each group. Current account data from Lane and Milesi-Ferretti (2018). Other national accounts data from the World Bank's World Development Indicators.

income in the first period is an exogenous endowment y. We also assume that the economy owes μb units of consumption good to a foreign lender that must be paid in the second period. We show the difference in savings and capital chosen by capitalists in the competitive equilibrium relative to what a social planner would choose and how a tax/subsidy would implement the planner's solution.

For the private equilibrium, workers simply consume their wages and so have payoffs

$$u(y) + u\big(w(K)\big) \tag{3.1}$$

while capitalists solve

$$\max_k u\big(y-k\big) + u\big(R(K)(k-b)\big) \tag{3.2}$$

which means that the aggregate capital stock satisfies

$$u'\big(y - \frac{K}{\mu}\big) = u'\bigg(R(K)(\frac{K}{\mu} - b)\bigg)R(K), \tag{3.3}$$

Where $K = \mu k$, $R(K) = F_k(K, 1-\mu)$, is the marginal product of capital arising from the aggregate production function $F(K, N)$. We assume that the production function has constant returns to scale and satisfies standard Inada conditions, so $w(K) = F(K, 1-\mu) - R(K)K$.

For a planner who chooses aggregate capital K directly, the maximization problem is given by

$$\max_K \mu\Big[u\big(y - \frac{K}{\mu}\big) + u\big(R(K)(\frac{K}{\mu} - b)\big)\Big] + (1-\mu)\Big[u(y) + u\big(w(K)\big)\Big], \tag{3.4}$$

which has first-order condition

$$u'\bigg(y - \frac{K}{\mu}\bigg) = u'\bigg(R(K)(\frac{K}{\mu} - b)\bigg)R(K)\bigg[1 + \frac{R'(K)(K-b)}{R(K)} + \frac{(1-\mu)u'\big(w(K)\big)}{u'\big(R(K)(\frac{K}{\mu} - b)\big)}\frac{w'(K)}{R(K)}\bigg]. \tag{3.5}$$

By inspection, the conditions for the capital in the competitive equilibrium and the planner's choice of capital differ by the multiplicative term

$$1 + \tau = \bigg[1 + \frac{R'(K)(K-b)}{R(K)} + \frac{(1-\mu)u'\big(w(K)\big)}{u'\big(R(K)(\frac{K}{\mu} - b)\big)}\frac{w'(K)}{R(K)}\bigg], \tag{3.6}$$

which means that the net tax or subsidy is given by τ and has both positive and negative terms. The first term is negative since $R'(K) < 0$ and $K > b$, but is smaller the higher is b. This is intuitive since raising capital reduces the amount of interest paid on foreign debt, which the planner internalizes but capitalists do not. The second term is positive since $w'(K) > 0$ and reflects the positive externality of capital on wages, which is internalized by the planner but not capitalists. This term is larger if wages are affected more by capital, but also if there are more workers (i.e. μ is small) or if insurance is poor, which translates to workers having large marginal utilities of consumption relative to capitalists (i.e. the ratio $\frac{u'\left(w(K)\right)}{u'\left(R(K)(\frac{K}{\mu} - b\right)}$ is large). While our quantitative model does not have hand-to-mouth workers, the existence of those with persistently low wealth near the borrowing constraint means that the welfare consequences of raising the savings of higher-wealth households mirrors this toy model. In addition, in the quantitative model we endogenize debt, b by explicitly modeling the rest of the world as a separate country. A change in the debtor's savings therefore has

spillover effects on capital in the lending economy that affect welfare.

3.2 Quantitative Model

We consider two economies, Home and Foreign, that may be financially integrated. Each country is inhabited by a representative—albeit competitive—firm and a continuum of infinitely lived households where the population measures may vary across countries. Time is infinite, and we consider allocations in a decentralized economy with sequential asset trade. The households are subject to uninsured idiosyncratic labor income shocks and borrowing constraints. We denote household-level variables by lowercase letters and economy-wide variables by uppercase letters.

3.2.1 Households

Households' expected life-time utility is given by,

$$E_0\left[\sum_{t=0}^{\infty}\beta^t\log(c_t)\right] \tag{3.7}$$

where $\beta \in (0,1)$ is the discount factor. Households choose consumption c_t, future level of physical capital stock k_{t+1}, and future holdings of a one-period non-state-contingent international bond b_{t+1}, facing the following budget constraint,

$$c_t + b_{t+1} + k_{t+1} = \varepsilon_t n w_t + [(1-\tau_t)(r_t^k - \delta) + 1]k_t + [(1-\tau_t)r_t^w + 1]b_t + TR_t, \tag{3.8}$$

where $\varepsilon_t n w_t$ is the labor income with w_t denoting the wage, n the amount of labor supplied, and ε_t the idiosyncratic efficiency shock. Labor is supplied inelastically, and both labor and capital are internationally immobile. The rates of return on the physical capital stock and on the international bond are $(r_t^k - \delta)$ and r_t^w, respectively, where $\delta \in (0,1)$ is the depreciation rate of capital. There is a wedge between the rate of return, paid by firms who rent capital stock or by issuers of the international bond, and the income that the households receive on those assets. That wedge can capture a variety of distortions that promote or discourage accumulation of wealth in each country, such as limited access to social security or medical insurance (Chamon and Prasad, 2010), tight regulations in the mortgage

markets (Michaud and Rothert, 2014), bottlenecks in the flows between savers and investors (Mendoza et al., 2007), etc. Rather than build a richer micro-founded framework, we have decided to use this parsimonious specification, because one of the countries in our model will be treated as the Rest of the World - a composite of countries with great deal of heterogeneity between them.[7] We model those distortions as a tax rate τ_t imposed on incomes from both assets (subsidies if $\tau_t < 0$). In order to focus on the distortionary aspect alone we assume the proceeds of those taxes are reimbursed in a lump-sum fashion as transfers, TR_t.

The idiosyncratic labor efficiency shock is the only source of uncertainty in the model. We consider an identical efficiency shock process in both countries, and the common shock process can be defined as a k-state ($k < \infty$) first order Markov process with a $k \times k$ transition probability matrix $\Pi = [\pi_{ij}]$, where $\pi_{ij} = \Pr(\varepsilon_{t+1} = \varepsilon_j | \varepsilon_t = \varepsilon_i)$. Households make their decisions on consumption, investment and labor in every period t after observing the shock ε_t. The finite history of these shocks from date 0 up to date t is denoted by $\varepsilon^t = \{\varepsilon_0, ..., \varepsilon_t\}$. The vector $p_t \in \mathbb{R}^k$ denotes the probability distribution over E at any period t. The distribution evolves according to $p_t = p_0 \Pi^t$ where p_0 is the initial distribution. We set $p_0 = p^* \equiv \lim_{t \to \infty} p_t$, i.e. the initial distribution is equal to the ergodic distribution. The aggregate effective labor supply N is a constant.

In addition to the budget constraint, the households face a borrowing constraint:

$$b_t + k_t = \underline{a}. \tag{3.9}$$

While the borrowing limit $\underline{a}$ is the same across households within each country, it might vary across countries.

Constraints (3.8) and (3.9) imply that the physical capital stock k and the international bond b are perfect substitutes for the household, which implies that the world interest rate equals the net return to capital in each country:

$$r_t^w = r_t^k - \delta \tag{3.10}$$

[7] The approach was pioneered by Chari et al. (2007), and has been heavily used in the literature on international capital flows. Examples include Gourinchas and Jeanne (2013), Steinberg (2019), or Rothert and Short (2023).

The condition above, and the fact that there is no aggregate uncertainty or default risk, imply that households make their savings decisions based only on their total asset holdings and are indifferent with respect to the composition of their portfolios. In particular, denoting the household wealth by a_t where

$$a_t \equiv b_t + k_t,$$

we can rewrite the period budget constraint,

$$c_t + a_{t+1} = \varepsilon_t n w_t + [1 + (1 - \tau_t) r_t^w] a_t + TR_t \tag{3.11}$$

and borrowing constraint,

$$a_t = \underline{a}. \tag{3.12}$$

Each household can be defined by a state vector (a_t, ε_t) with the initial conditions (a_0, ε_0). Since there is no aggregate uncertainty, households have perfect foresight on the future prices of the economy. Taking prices, initial wealth and productivity as given, the household maximizes (3.7) subject to (3.11) and (3.12). The household aims to avoid negative levels of consumption, therefore the possibility of having a series of low productivity shocks along with the limitations on borrowing induce households to accumulate precautionary savings, as in the Aiyagari (1994) framework. A tighter borrowing constraint yields greater aggregate savings in each economy, while cross-country differences in borrowing limits result in global financial imbalances, as also argued in Mendoza et al. (2009b) and Kabukçuoğlu (2017).

3.2.2 Firms

In each country, there is a single, competitive firm that maximizes profits subject to a constant returns to scale technology. Aggregate output Y_t is produced using aggregate capital and labor,

$$Y_t = F(K_t, N). \tag{3.13}$$

Firm's profits can be written as

$$F(K_t, N) - r_t^k K_t - w_t N \tag{3.14}$$

Under perfect competition, firms demand capital and labor services that are supplied by households, taking the rental and wage rates, r_t^k and w_t, as given.

3.2.3 Equilibrium

The solution to the household's problem yields the decision rules for consumption, $c_t = f_c(a_t, \varepsilon_t)$ and asset holdings, $a_{t+1} = f_a(a_t, \varepsilon_t)$ given the initial conditions (a_0, ε_0) and the history of idiosyncratic shocks ε^t. Based on these decision rules, it is possible to obtain the joint distribution of agents over the states, $g_t(a_t, \varepsilon_t)$. Given the initial distribution $g_0(a_0, \varepsilon_0)$, and these decision rules, the distribution functions follow the rule

$$g_{t+1}(a_{t+1}, \varepsilon_{t+1}) = \sum_{\varepsilon_{t+1}} \Pi(\varepsilon_{t+1}|\varepsilon_t) g_t(f_a^{-1}(a_{t+1}, \varepsilon_t), \varepsilon_t). \tag{3.15}$$

We describe the equilibrium under financial integration as follows.[8]

Definition 3.1. Given the initial distributions $g_0(a_0, \varepsilon_0)$ and $g_0^*(a_0^*, \varepsilon_0)$, aggregate assets, A_0 and A_0^*, and capital K_0 and K_0^*, a general equilibrium under financial integration is defined by 1. A 4-tuple of sequences of household policy functions,

$$[f_a(a_t, \varepsilon_t), f_c(a_t, \varepsilon_t), f_a^*(a_t, \varepsilon_t), f_a^*(a_t, \varepsilon_t)]_{t=0}^{\infty}$$

2. a competitively determined, deterministic 5-tuple of price sequences,

$$[w_t, w_t^*, r_t^k, r_t^{k*}, r_t^w]_{t=0}^{\infty}$$

3. a deterministic 6-tuple of sequences of country-level aggregates,

$$[C_t, C_t^*, A_{t+1}, A_{t+1}^*, K_{t+1}, K_{t+1}^*]_{t=0}^{\infty}$$

4. distributions

$$[g_t(a_t, \varepsilon_t), g_t^*(a_t^*, \varepsilon_t)]_{t=0}^{\infty}$$

such that given prices, (i) the policy functions solve households' optimization problem, (ii) firms optimize, (iii) the aggregates are consistent with household decisions,

$$\int_{(a,\varepsilon)} f_c(a_t, \varepsilon_t) dg_t = C_t, \int_{(a,\varepsilon)} f_a(a_t, \varepsilon_t) dg_t = A_{t+1}$$

$$\int_{(a,\varepsilon)} f_c^*(a_t, \varepsilon_t) dg_t^* = C_t^*, \int_{(a,\varepsilon)} f_a^*(a_t^*, \varepsilon_t) dg_t^* = A_{t+1}^*$$

[8] We provide a characterization of optimality conditions for households and firms in Appendix B.

(iv) labor markets clear:

$$\int_{(a,\varepsilon)} \varepsilon_t n dg_t = N, \int_{(a,\varepsilon)} \varepsilon_t n^* dg_t^* = N^*,$$

(v) Asset markets clear:

$$A_t + A_t^* = K_t + K_t^*$$

(vi) Government budget holds:

$$\int_{(a,\varepsilon)} \tau_t r_t^w a_t dg_t = TR_t, \int_{(a,\varepsilon)} \tau_t^* r_t^w a_t^* dg_t^* = TR_t^*$$

(vii) The distributions are consistent with the initial distribution, household decisions and idiosyncratic shocks for all t.

Using the aggregates, it is possible to derive the following variables of external accounts. In particular, we denote the net foreign assets,

$$B_t \equiv A_t - K_t,$$

and current account,

$$CA_t \equiv B_{t+1} - B_t,$$

and trade balance,

$$TB_t \equiv B_{t+1} - B_t(1 + r_t^w).$$

Foreign variables can be defined similarly.

4 Quantitative analysis

We calibrate the two countries to the U.S. and Rest of the World (ROW)[9]. Our calibration strategy involves two goals. First, we aim to generate the current account dynamics observed in the data. To this end, we start from the steady state in 1990 where the two countries are in a financial autarky, and differ in terms of their borrowing constraints, populations,

[9]Following Mendoza et al. (2009b), these countries include OECD countries and a group of emerging economies: Argentina, Brazil, Chile, China, Colombia, Costa Rica, Ecuador, Egypt, El Salvador, Hong Kong, India, Indonesia, Malaysia, Morocco, Nigeria, Pakistan, Peru, Philippines, Singapore, Sri Lanka, South Africa, Taiwan, Uruguay, and Venezuela.

and total factor productivity levels, therefore country size. Second, we aim to match the highly concentrated wealth distribution for Home (the U.S.). For Foreign, while we adopt the same labor income shock process as the one we use for Home, the resulting initial wealth distributions can be different due to differences in other parameters.

Calibration: We specify the production technology based on the Cobb-Douglas production function, $Y = ZK_t^{\alpha}N^{1-\alpha}$. We calibrate the mass of households and TFP parameters to match the average relative population size and GDP ratios in the 1980-1990 period, based on the World Economic Indicators database of the World Bank. Accordingly, the U.S. population share in this pair of countries for 1990 was 0.07. Therefore, we set the mass of households to be 0.07 in the U.S. and 0.93 in ROW. The productivity parameters must be set in order to match the GDP per capita ratio between the ROW and the U.S.:

$$\frac{y^*}{y} = \left(\frac{Z^*}{Z}\right)^{\frac{1}{1-\alpha}},$$

which was 0.32 in this period. We set $\alpha = 0.40$ for both countries and normalize the U.S. productivity parameter $Z = 1$, which then yields $Z^* = 0.42$. We set the discount factor, $\beta = 0.978$ in order to match a capital-output ratio of 3.5 for both countries. The depreciation rate is $\delta = 0.10$.

Generating a realistic wealth distribution in this BIHA model is crucial for our exercise, and yet a challenging task. The U.S. economy has a highly-concentrated wealth distributions, as do other major economies in the ROW. In order to match the distributions across different quintiles as closely as possible, we follow the approach of Domeij and Heathcote (2004) to calibrate the parameters of the Markov process.

Accordingly, we first take a look at the empirical literature for the parameter estimates of the $AR(1)$ process of (logged) earnings, $e_j = \rho e_{j-1} + \eta$ with $\eta \sim \mathcal{N}(0, \sigma_\eta^2)$. For the U.S., we follow Domeij and Heathcote (2004) and consider the values $\rho = 0.9$ and $\sigma_\eta^2 = 0.05$, which are consistent with the estimates of studies based on the Panel Study of Income Dynamics (PSID) data.

We assume a 3-state Markov process for each country, so households are subject to high, medium or low levels of productivity shocks, ε^h, ε^m, and ε^l, respectively. Using the param-

eters of the earnings process above as an input, our goal is to determine the productivity levels as well as the parameters of the Markov transition matrix, which has the form

$$\Pi = \begin{bmatrix} \pi_{11} & 1-\pi_{11} & 0 \\ \frac{1-\pi_{22}}{2} & \pi_{22} & \frac{1-\pi_{22}}{2} \\ 0 & 1-\pi_{11} & \pi_{11} \end{bmatrix}.$$

Normalizing $\varepsilon^m = 1$ in each country, it is then possible to find the remaining productivity shock levels ε^h and ε^l and the transition probabilities, π_{11} and π_{22} using the equations that satisfy the properties of the Markov transition matrix.

The income shock process is calibrated to match a realistic overall wealth distribution for the U.S. based on Díaz-Giménez et al. (2011) and more recently, Kuhn and Ríos-Rull (2016). Accordingly, wealth inequality in the U.S. increased over time. Based on our calibration, the poorest 20% of households in the model hold -1.6% of the total wealth in the economy, compared to -0.2% in the data (Table 2). The richest 20% own 83.4% of total wealth in the model compared to 87% in the data. Finally, the U.S. wealth Gini in the model and data are 0.82 and 0.85, respectively. We follow the same calibration for the ROW parameters which do not have a target for comparison, but the Gini coefficient for the ROW in the model appears to be consistent with the high wealth inequality in other countries in the world. For instance, the largest lender economies of Japan, China and Germany have GINI coefficients of 0.63, 0.76, and 0.82 respectively. Finally, we set the borrowing limit for Foreign as -0.02 following Mendoza et al. (2009a), and calibrate the U.S. borrowing limit at -1.2 to generate realistic NFA imbalances in the financial integration steady state. Table 1 reports the calibrated parameter values.[10]

The initial (autarky) steady state allocations, prices, and distributions of wealth across countries are reported in Table 2. In the financial autarky equilibrium, the U.S. real interest rate is higher than that of China, and the output ratios (hence, the relative size of these countries) match the data. In terms of the wealth distributions, the two-country framework generates realistic asset holding positions across quintiles and overall distributions as captured by the Gini coefficients.

[10]Our solution method for policy functions follows Kabukçuoğlu and Martínez-García (2021), a combination of time-iteration and the endogenous grid method (Carroll, 2006)).

Table 1: Calibration

	Home (U.S.)	Foreign (ROW)
Population size	0.07	0.93
Discount factor β	0.978	0.978
Depreciation rate δ	0.10	0.10
TFP parameters Z, Z^*	1	0.42
Capital's share in production α	0.40	0.40
Borrowing limits $\underline{a}, \underline{a}^*$	-1.2	-0.02
Initial savings wedge τ, τ^*	0	0
Transition probability π_{11}	0.90	0.90
Transition probability π_{22}	0.98	0.98
High productivity shock ε^h	3.94	3.94
Medium productivity shock ε^m	1	1
Low productivity shock ε^l	0.25	0.25

Quantitative experiments. We start from year 1990 when Home and Foreign are in financial autarky. Our first step is study the transition to a steady state with full financial integration, aiming to mimic the emergence of global imbalances in net foreign assets by Home and Foreign. Then, in year 2020, we study two scenarios: the enaction of a one percent subsidy on asset returns in Home, and the enaction of a one percent tax on asset returns in Foreign. The two scenarios, depicted in Figure 4, capture two different policies aimed at reducing the global imbalances. The first one tries to increase savings in Home (the borrowing country), while the second one tries to increase consumption in Foreign (the lending country). Both involve unanticipated and permanent policies.

5 Results

We will split the discussion of our results into three major parts: long-run impact on allocations and prices, transition dynamics towards the new steady-state, and welfare effects in the two countries.

5.1 Long-run equilibrium

Table 3 summarizes changes in long-run equilibrium allocations and factor prices under financial integration, under global rebalancing due to a subsidy on Home's asset returns (called

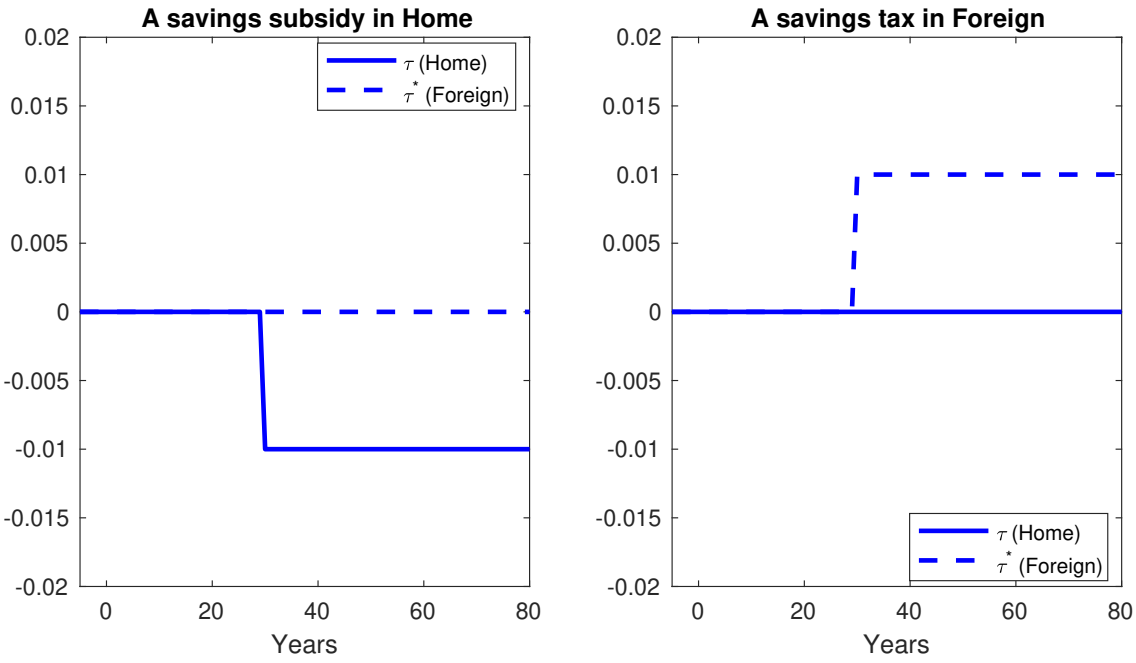

Figure 4: Scenario 1 (left panel): Introducing a one percent savings subsidy in Home. Scenario 2 (right panel): Introducing a one percent savings tax in Foreign

Rebalancing 1), and under rebalancing due to a tax on Foreign's asset returns (Rebalancing 2), all compared to the initial autarkic steady state.

Scenario 0: Financial integration. A complete process of financial integration leads to large net external imbalances of the two economies in the long-run: the net external debt of the Home reaches 32.5% of GDP and the net external surplus of the Foreign reaches 10.4% of GDP. These values are in line with the observed net foreign asset imbalances in the data, even though we did not target them in our calibration. While the two countries differ in terms of a number of parameter values, the main driver of these imbalances in the model is the differences in the borrowing limits, which can be interpreted as a heterogeneity in the financial development levels of Home and Foreign (Mendoza et al. (2007, 2009b)). With financial integration, Home also start accumulating more capital, and have a higher output level in the long run. The change in capital is associated with lower interest rates and higher wages relative to autarky. Foreign experience changes in the opposite direction: a decline in capital stock, a decline in wages and an increase in the interest rate. A full financial

Table 2: Financial autarky steady state

Allocations and prices			
	Home	Foreign	
Net foreign assets B_0	0.0	0.0	
Capital-to-GDP ratio, K/Y	3.5	4.5	
Output, Y	0.16	0.50	
Real interest rate, r_0 (%)	1.52	1.45	
Real wage, w	1.4	0.3	
Wealth distribution			
	Home		Foreign
Asset holdings (%)	Model	Data	Model
$q1$ (poorest 20%)	-1.6	-0.7	0.9
$q2$ (20% – 40%)	-0.6	0.6	1.6
$q3$ (40% – 60%)	1.3	3.2	2.8
$q4$ (60% – 80%)	17.5	9.8	16.4
$q5$ (richest 20%)	83.4	87.0	78.4
Wealth Gini	0.82	0.85	0.74

integration increases the wealth inequality in Home and reduces it in Foreign as indicated by the respective change in the Gini coefficients for wealth.

Table 4 shows the results on long-run wealth distributions. Accordingly, financial integration leads to greater wealth inequality for Home relative to autarky (the Gini coefficient goes up from 0.82 to 0.84). This mainly occurs since the level of indebtedness of the households at the bottom two quintiles increases further, while those at the upper quintiles experience an even greater wealth accumulation. Hence, wealth inequality increases despite the favorable (unfavorable) impacts from prices for the wealth poor (rich) through a decline in interest rates and a rise in wages. In turn, Foreign's Gini coefficient changes from 0.74 to 0.73, resulting in lower wealth inequality.

Scenario 1: A savings subsidy in Home under financial integration. A one percent subsidy in Home's asset returns (Relabancing 1) causes a rightward shift in the aggregate asset supply by households as depicted in Figure 5. This greater long run wealth accumulation in Home leads to a lower (pre-subsidy) world interest rate, as well as lower capital rental rates in the two countries. In turn, capital, output and wages go up in both countries. At a lower world interest rate, Foreign households save less, and total wealth in

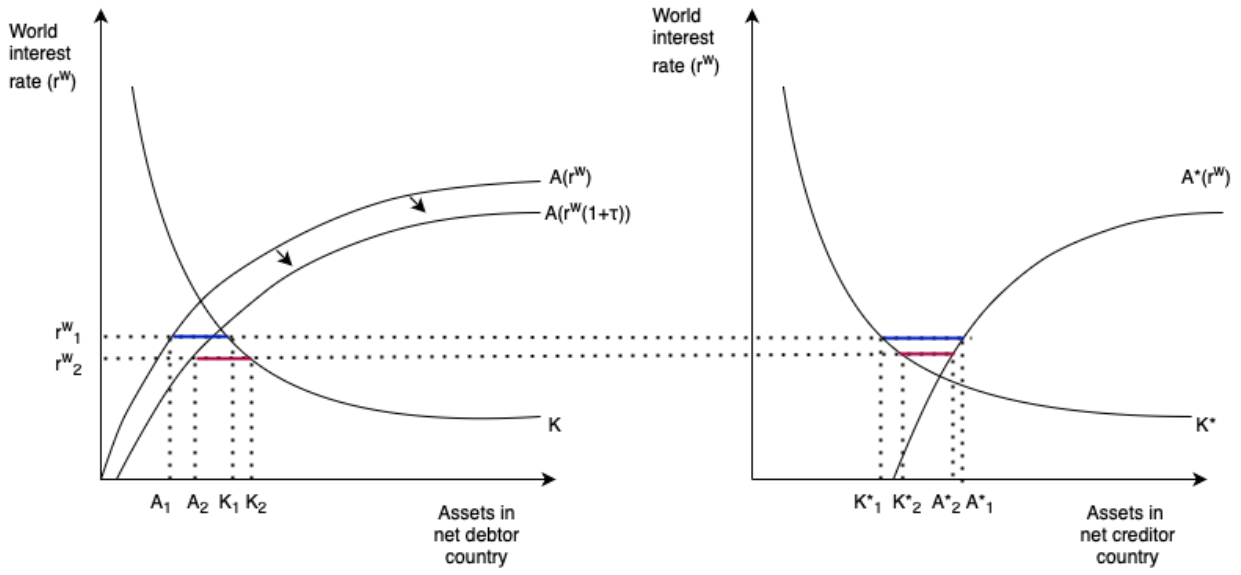

Figure 5: A savings subsidy in the net debtor country

Foreign declines. Consistent with its goal, this subsidy also deters international borrowing by Home, and the net foreign asset-to-GDP ratio for Home (Foreign) shrinks to -26.4% (10.4%).

Reducing the NFA imbalances through this scenario offsets some of the negative impacts of financial integration for Foreign, with a partial recovery in its capital and output. This scenario amplifies the positive effects of financial integration for Home.

Table 3: Long-run effects of Financial Integration and Rebalancing - allocations and prices

% change relative to fin. autarky	Home (U.S.)			Foreign (ROW)		
	Integration	Rebalancing 1	Rebalancing 2	Integration	Rebalancing 1	Rebalancing 2
B/Y $(\%pt)$	-32.5	-26.4	-26.0	10.4	8.4	8.3
K	0.8	0.9	0.6	-0.3	-0.2	-0.4
Y	0.3	0.4	0.2	-0.1	-0.1	-0.2
$r^w(1-\tau)$ (%)	1.47	1.48	1.48	1.47	1.46	1.46
w	0.3	0.3	0.3	-0.1	-0.1	-0.2

Note: After-tax or after-subsidy returns, $r(1-\tau)$, are in levels (%). All remaining variables are in percentage or percentage point deviations from the autarky steady state.

As Table 4 shows, introducing a subsidy in Home reduces the wealth inequality in Home in the long run. The opposite is true for Foreign. The Gini coefficient goes down to 0.81 in

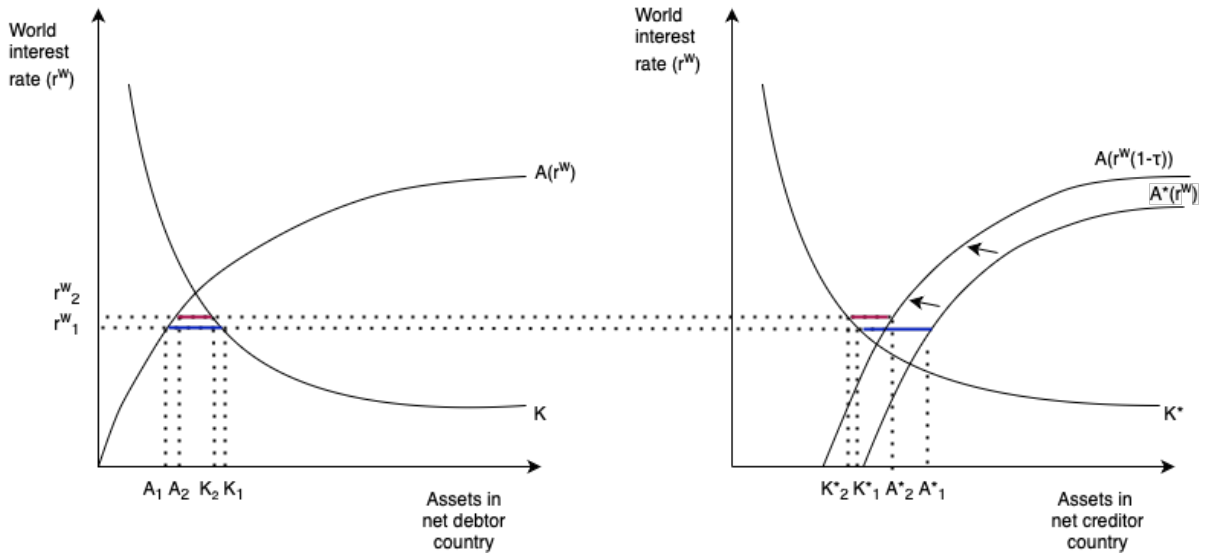

Figure 6: A savings tax in the net creditor country

Home and almost remains the same at 0.73 in Foreign.

Scenario 2: A savings tax in Foreign under financial integration. In terms of the resulting imbalances in the net foreign asset positions, a one percent tax on asset returns enacted in Foreign helps achieve a similar result as Scenario 1 with a one percent subsidy on asset returns in Home (Rebalancing 2). The net foreign asset positions are -26% and 8.3% of GDP, respectively. However, since the policy involves a tax on assets rather than a subsidy, Foreign households save less (and the asset supply curve in Foreign shift to the left as in Figure 6), implying higher (pre-tax) world interest rates in equilibrium. The rental rates go up, while wages, capital and output go down.

For Foreign, trying to reduce the NFA imbalances amplifies the negative effects of financial integration on capital and output. For Home, the tax policy abroad creates negative spillover effects and takes away some of the gains on capital and output from globalization. A decline in wages and a rise in interest rates also create unfavorable effects for the wealth-poor who mostly rely on labor income.

Under this scenario, the resulting wealth distributions are virtually the same as those from Scenario 1 (Rebalancing 1) and there is lower wealth inequality relative to financial integration. The wealth Gini coefficients are 0.81 and 0.73, respectively.

Table 4: Long-run effects of Financial Integration and Rebalancing - wealth distributions

	Home (U.S.)			Foreign (ROW)		
Asset holdings (%)	Integration	Rebalancing 1	Rebalancing 2	Integration	Rebalancing 1	Rebalancing 2
$q1$ (poorest 20%)	-1.93	-1.85	-1.86	0.89	0.88	0.88
$q2$ (20% – 40%)	-1.03	-0.95	-0.95	1.6	1.59	1.58
$q3$ (40% – 60%)	0.53	0.69	0.68	2.9	2.89	2.86
$q4$ (60% – 80%)	16.44	16.66	16.65	16.76	16.69	16.68
$q5$ (richest 20%)	85.99	85.45	85.47	77.87	77.95	78.0
Wealth Gini	0.84	0.81	0.81	0.73	0.73	0.73

Note: The values in the upper panel indicate percentage of assets held by households across quintiles.

5.2 Transition Dynamics

The dynamic responses to the two rebalancing policies are presented in Figures 7 and 8. Figures 7 focuses on the dynamic response of variables related to each country's domestic variables, while Figure 8 focuses on the wealth and its external sector. The two policies considered have a very similar quantitative impact on the net foreign asset position in the two countries, as shown in the top left panel of Figure 8.

The figures confirm the results discussed in the previous section: savings subsidy introduced by Home leads to higher capital stock, output, and wages in both countries, whereas the savings tax introduced by Foreign has the opposite effect, as illustrated in Figure 7.

The key insights from looking at the transition dynamics is that the short-term vs. the long-term responses of the current account and the net foreign asset position are different. While in the long run Home ends up with a smaller net external debt to GDP ratio, in the short run their net foreign asset position drops on impact, in response to either of the two policies considered. Similarly, the net foreign asset position of Foreign increases on impact, only to steadily decline in the long run.

This pattern is consistent with each country's long-run budget constraint and consumption smoothing: along a transition path towards a reduced (an increased) net foreign asset deficit (surplus), Home (Foreign) borrows (lends) even more.

With both policies, the changes in net foreign assets explain the larger part of the dynamics of the country's overall wealth, rather than the capital stock, which responds to

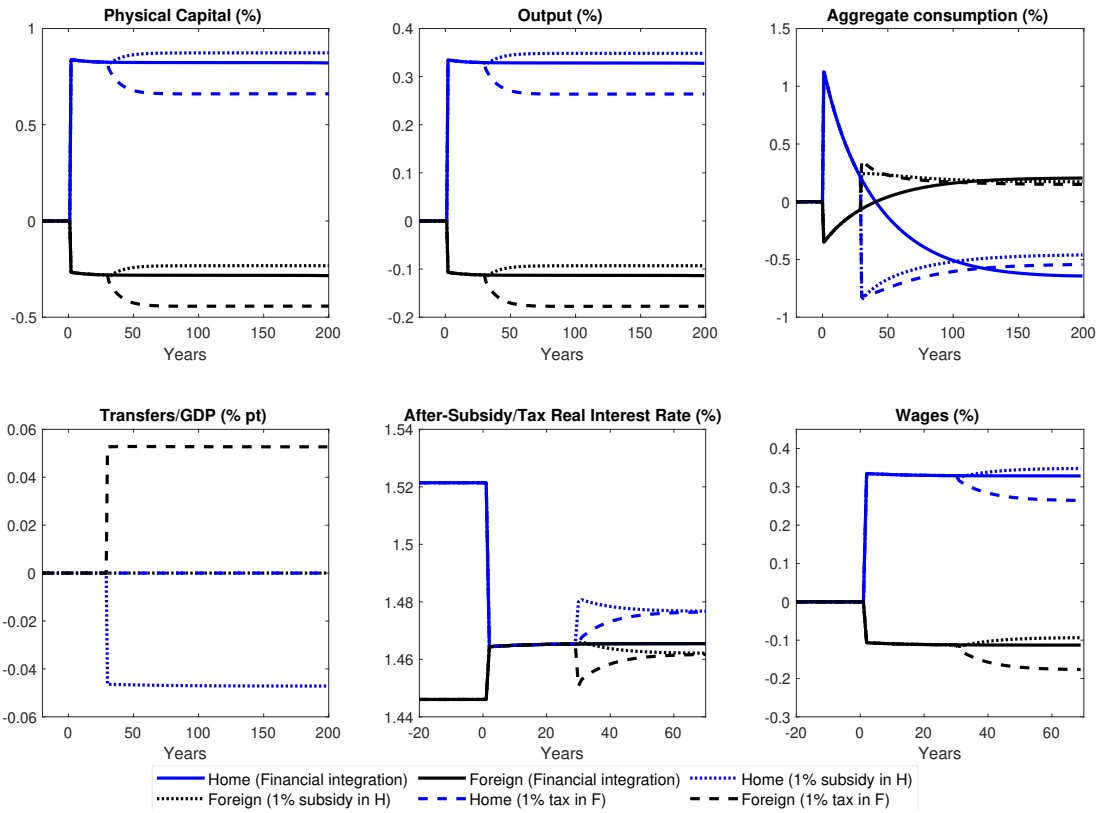

Figure 7: Transition paths in response to: financial integration (solid line), a savings subsidy in Home (dotted line), a savings tax in Foreign (dashed line) — Percentage or percentage point deviations from autarky values are plotted.

policy relatively less strongly. In the long run, Home accumulates more wealth relative to full financial integration, and enjoys higher consumption. Foreign wealth level declines in the long run with a consumption level below the financial integration steady state.

5.3 Welfare effects

Welfare effects at the household level: To compute welfare effects, we calculate the consumption equivalent welfare gain from a policy implemented at $t = t_0$ for a household in

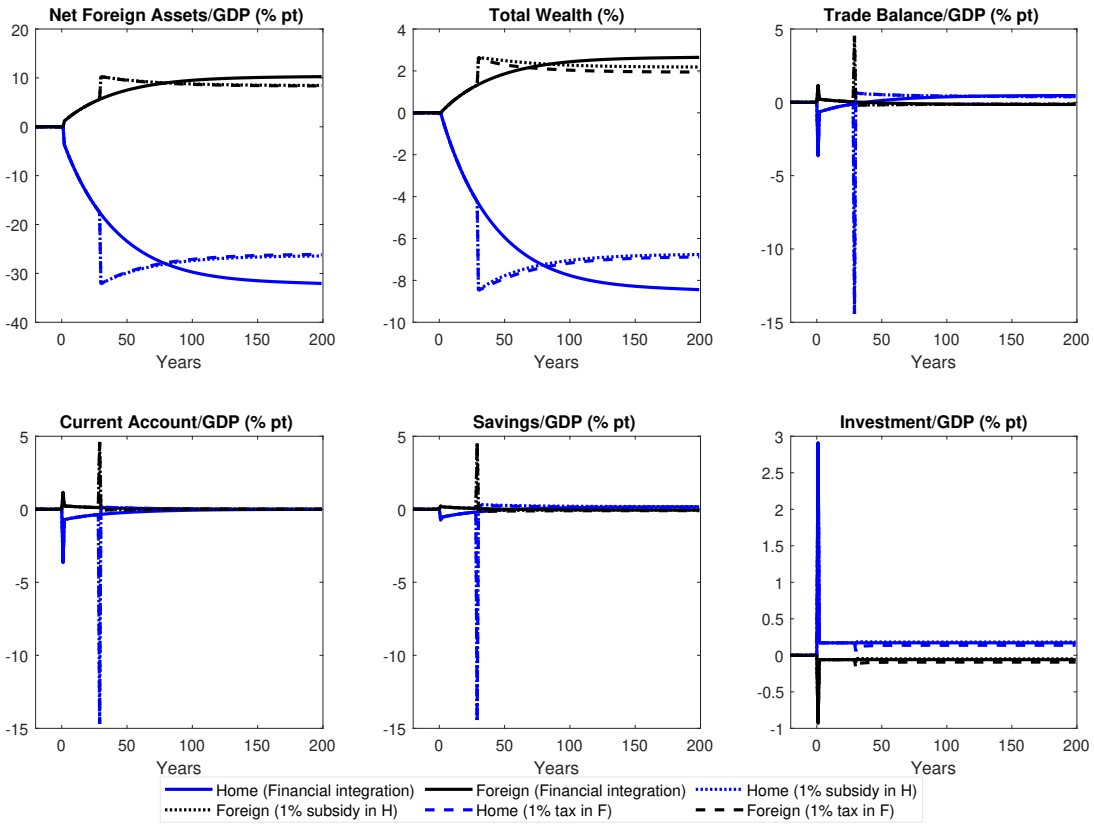

Figure 8: Transition paths in response to: financial integration (solid line), a savings subsidy in Home (dotted line), a savings tax in Foreign (dashed line) — Percentage or percentage point deviations from autarky values are plotted.

any country indexed by the two states (a_t, ε_t) as follows:

$$E_t \sum_{t=t_0}^{\infty} \beta^t \log(c_t^{FI}(1 + \Delta(a_{t_0}, \varepsilon_{t_0})) = E_t \sum_{t=t_0}^{\infty} \beta^t \log(c_t^{policy}). \tag{5.1}$$

where *policy* can be a savings subsidy in Home or a savings tax in Foreign. The welfare gain $\Delta(a_{t_0}, \varepsilon_{t_0})$ for each household in state pair $(a_{t_0}, \varepsilon_{t_0})$ can be interpreted as the proportional increase in the consumption of a household under financial integration that would make the household indifferent between staying in financial integration without a policy change and going through a policy change.

Figure 9 presents the welfare gains from the two polices across households of different

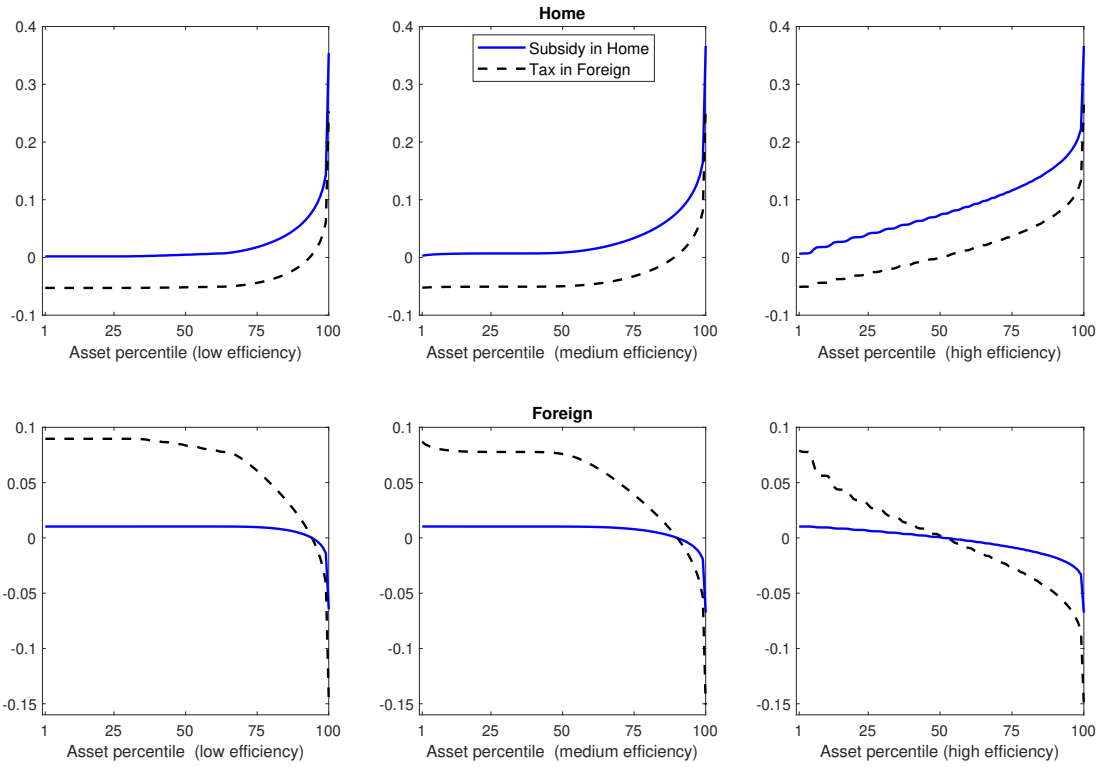

Figure 9: Welfare gains from a 1% subsidy and 1% tax in Home and Foreign, respectively. The welfare gains are given for households from each country across various asset holding percentiles (1st poorest-100th richest) as well as low, medium and high labor efficiency levels are plotted, respectively. The welfare gains are calculated relative to financial integration in year 2020 when each policy is implemented.

percentiles of wealth distribution and labor efficiency levels in both countries, starting from t_0 which corresponds to year 2020 in our model.

Welfare effects of a Home savings subsidy: A savings subsidy yields small positive welfare gains for the poor in Home, and larger positive welfare gains for the rich. (See Figure 9). As Table 5 also reports, Home's subsidy policy can be supported unanimously by Home residents. In Foreign, there are negative welfare effects for the rich, but the subsidy policy benefits 81% of households in Foreign.

In Home, a savings subsidy increases both wages and after-subsidy real returns. While

an increase in wages helps all households in the economy, it particularly helps the poor who predominantly rely on labor income. In contrast, an increase in after-subsidy real returns has a negative impact on indebted households. Over time, these negative effects may be mitigated since the overall indebtedness in the economy (as measured by net foreign assets/GDP) goes down and wealth goes up (Figure 8). Note that these positive welfare effects prevail even for the poorest households in the economy, even though the subsidy is financed by a lump-sum tax—i.e. a regressive subsidy policy.

In Foreign, in response to a savings subsidy abroad, there are initial positive welfare effects for indebted households since both wages go up and real returns go down. So, this change in price dynamics can be welcomed by the poor but not by the rich—the decline in real returns generates a negative welfare effect for households with positive amounts of wealth.

Welfare effects of a Foreign savings tax: The tax policy in Foreign is much less desirable for Home: only 19% of households—mainly the poor—enjoy positive welfare gains (Table 5). The policy generates benefits for the majority in Foreign with a support from 80% of the population. A savings tax in Foreign induces a decline in wages in both countries. Real returns go up in Home and therefore, the policy can be supported by a small fraction of households that are at the top of the wealth distribution. In Foreign, both wages and after-tax returns go down and the policy enables a lump-sum transfer for all households, hence, there are additional welfare benefits from this progressive tax policy. In particular, poor households still suffer from a decline in wages, while benefiting from decreases in (after-tax) real returns and lump-sum transfers. For the rich, the loss in income from declining wages and real returns are too big to be offset by the lump-sum transfers and there is a welfare loss for this group of households.

Welfare effects at the country level: We assume a benevolent social planner assigning equal weights to households in each country. We then aggregate the individual welfare gains over distributions at $t = t_0$, to obtain country-level welfare gains from:

$$\int_{(a_{t_0},\varepsilon_{t_0})} E_t \sum_{t=t_0}^{\infty} \beta^t log(c_t^{FI}(1+\Delta)) dg(a_{t_0},\varepsilon_{t_0}) = \int_{(a_{t_0},\varepsilon_{t_0})} E_t \sum_{t=t_0}^{\infty} \beta^t log(c_t^{policy}) dg(a_{t_0},\varepsilon_{t_0}). \quad (5.2)$$

Table 5: Welfare Effects

Welfare gain (% of cons.)	Home	Foreign
Financial integration (relative to autarky)	0.24	1.84
1% subsidy in Home	0.04	0.00
1% tax in Foreign	-0.02	0.02
1% subsidy in Home in 10 years	0.04	0.00
Fraction in favor:		
Financial integration (relative to autarky)	89%	100%
1% subsidy in Home	100%	81%
1% tax in Foreign	19%	80%
1% subsidy in Home in 10 years	100%	82%

Note: Top rows in each panel report welfare effects of financial integration relative to autarky in year 1990 had the economy stayed in the status quo forever. The remaining rows report values for welfare effects of each policy enacted in 2020 and are relative to financial integration.

From Equation 5.2, we find that Home's and Foreign's aggregate welfare gain Δ from a subsidy in Home is 0.04% and 0.00%, respectively. If a savings tax in Foreign is implemented instead, these values are given by -0.02% and 0.02%, respectively (Table 5). Hence, the conclusion from these policy experiments is that a more universally desirable policy involves increasing savings in Home through a savings subsidy.

Discussion: Our intuition for the results is consistent with the insights of Dávila et al. (2012) who study constrained-efficiency in an BIHA economy with high wealth inequality. Accordingly, households' asset holdings are much too low in a decentralized equilibrium with uninsured idiosyncratic labor income risk. Hence, a policy prescription in the decentralized economy is to increase households' asset holdings. In our framework, this can be attained for Home with any of the two policies—both a savings subsidy in Home and a savings tax in Foreign increase wealth mainly by reducing external indebtedness in the long run. Conversely, these policies reduce wealth in Foreign, possibly pushing the economy further below the constrained-efficient level of wealth in equilibrium.

Welfare effects in the short-run vs. long-run: To better assess short-term and long-term welfare implications, we construct an alternative metric below, and report our results

in Figure 10.

$$\int_{(a_{t_0},\varepsilon_{t_0})} E_t \sum_{t=t_0}^{\tau} \beta^t \log(c_t^{FI}(1+\Delta_\tau)) dg(a_{t_0},\varepsilon_{t_0}) = \int_{(a_{t_0},\varepsilon_{t_0})} E_t \sum_{t=t_0}^{\tau} \beta^t \log(c_t^{policy}) dg(a_{t_0},\varepsilon_{t_0}) \quad (5.3)$$

for $\tau = t_0 + 1, t_0 + 2, ...$

Accordingly, for both countries the potential benefits or losses from the policies are fully materialized in a period of at least 200 years. Home households can enjoy about one quarter of these benefits from their subsidy within the first 20 years of its implementation.

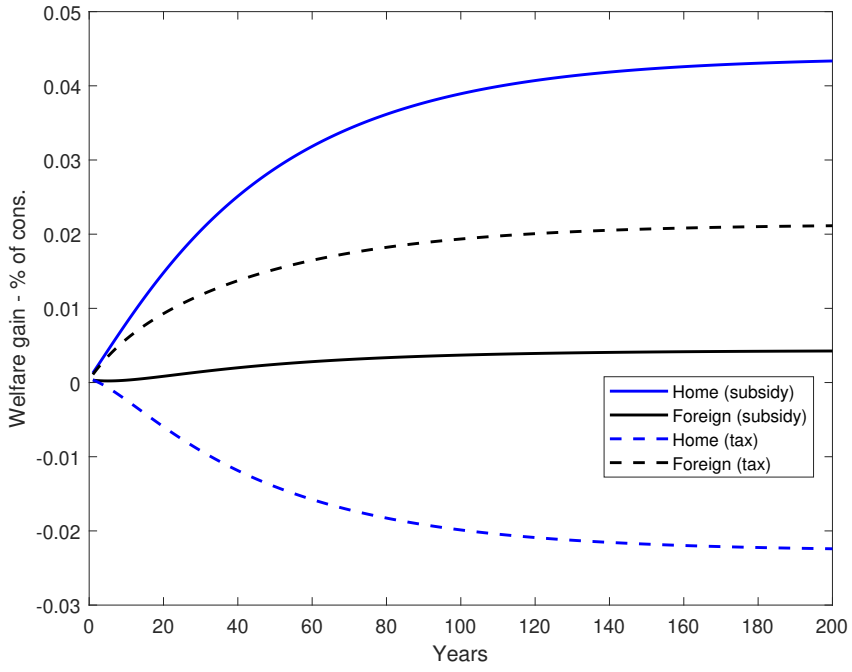

Figure 10: Welfare gains along the transition path from a 1% subsidy and 1% tax in Home and Foreign, respectively. The aggregate welfare gains are computed from year 0 up to year t for $t = 1, 2, ...$ in the transition path.

Wealth Inequality: The patterns for wealth Gini coefficients are plotted in Figure 11. Accordingly, wealth Gini coefficients appear to be inversely related to the paths of total wealth and net foreign assets in each country.

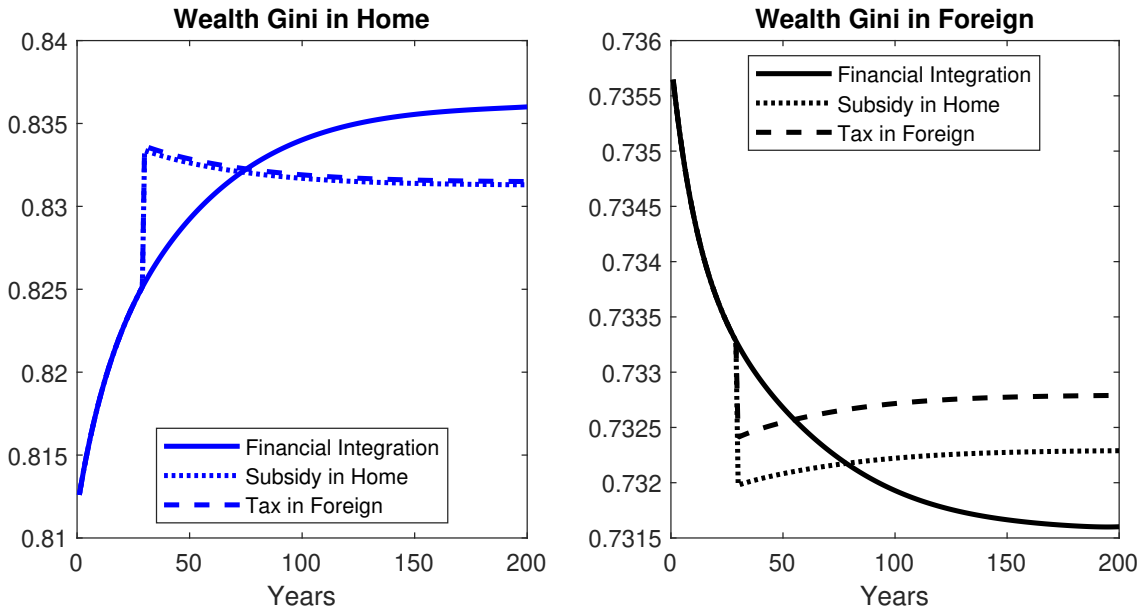

Figure 11: We plot Wealth Gini coefficients for the transition paths of (i) financial integration (solid line), (ii) a 1% savings subsidy in Home implemented in 1 year (dotted line), (iii), a 1% savings tax in Foreign implemented in 1 year (dashed line), respectively. Each policy is enacted in year 2020 (period 30) in the model.

In this model, a greater accumulation of wealth in a country will drive households further away from the borrowing limit and reduce inequality. Likewise, if there is an improvement in the net foreign asset position, households indebtedness will decline and this will also improve inequality.

For Home, we observe a gradual increase in wealth inequality since the start of the process of financial globalization, consistent with data for the U.S. households and the results of Mendoza et al. (2007). In this period, the U.S. net foreign assets declined. A policy prescription from our model would then be to induce more savings in Home in the long-run by a subsidy at home.

5.4 Implementing a subsidy slowly vs. fast

Our baseline model does not feature adjustment costs on external balances, so exhibits large spikes in the stock of net foreign assets around reforms. In reality, capital adjustment costs

likely smooth net foreign assets around a policy reform. Furthermore, policies are often implemented slowly over time rather than all at once. We show that our welfare results are robust to a slower adjustment of net foreign assets by implementing the policy gradually. Instead of a 1% subsidy enacted in year 2020, we consider a subsidy that takes on values $0.1\%, 0.2\%, ..., 1\%$ from 2020 over a ten-year period.[11]

There are no long run differences as the steady states from the two experiments as the long-run subsidy is the same for both scenarios. The transition dynamics from this alternative exercise is also quantitatively very similar to the one with the quicker adjustment in subsidy, although the current exercise yields slightly lower capital accumulation in Home and higher capital accumulation in Foreign. The gradual change in real interest rates have less negative effects on the indebted households in Home (See Figure 12.)

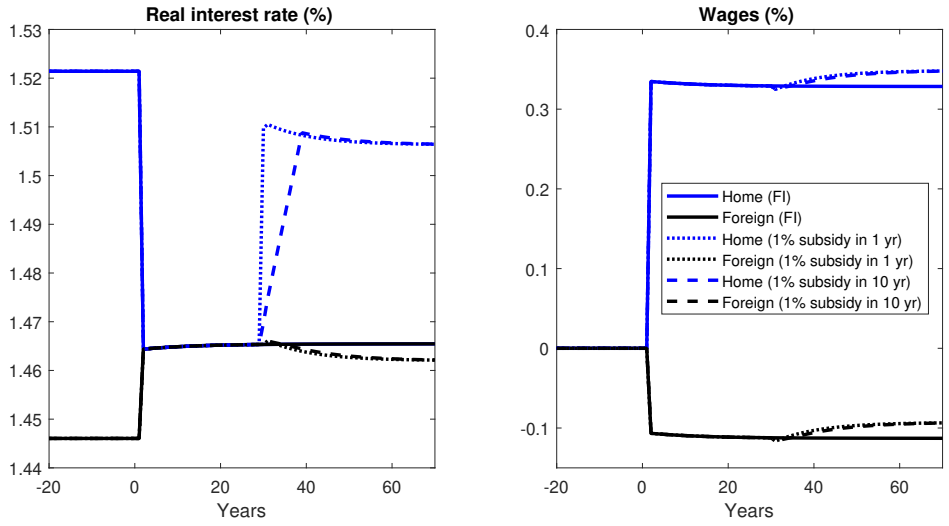

Figure 12: Effects of a savings subsidy in Home implemented in 1 year and 10 years

The welfare implications of this policy can be seen in Figure 13. A more gradual subsidy to increase long run savings in Home generates a slightly bigger (smaller) welfare gain for the poor (rich) in Home, as opposed to a slightly smaller welfare gains (losses) for the poor (rich) in Foreign. Table 5 reports the aggregate welfare implications from and fractions in favor of a gradual implementation of the subsidy policy. The main result does not change:

[11] The first time the subsidy policy is enacted it is unanticipated. But after one year, it becomes anticipated.

a subsidy, implemented fast or slowly, unanimously helps the households in Home and the majority in Foreign (82%) in Foreign.

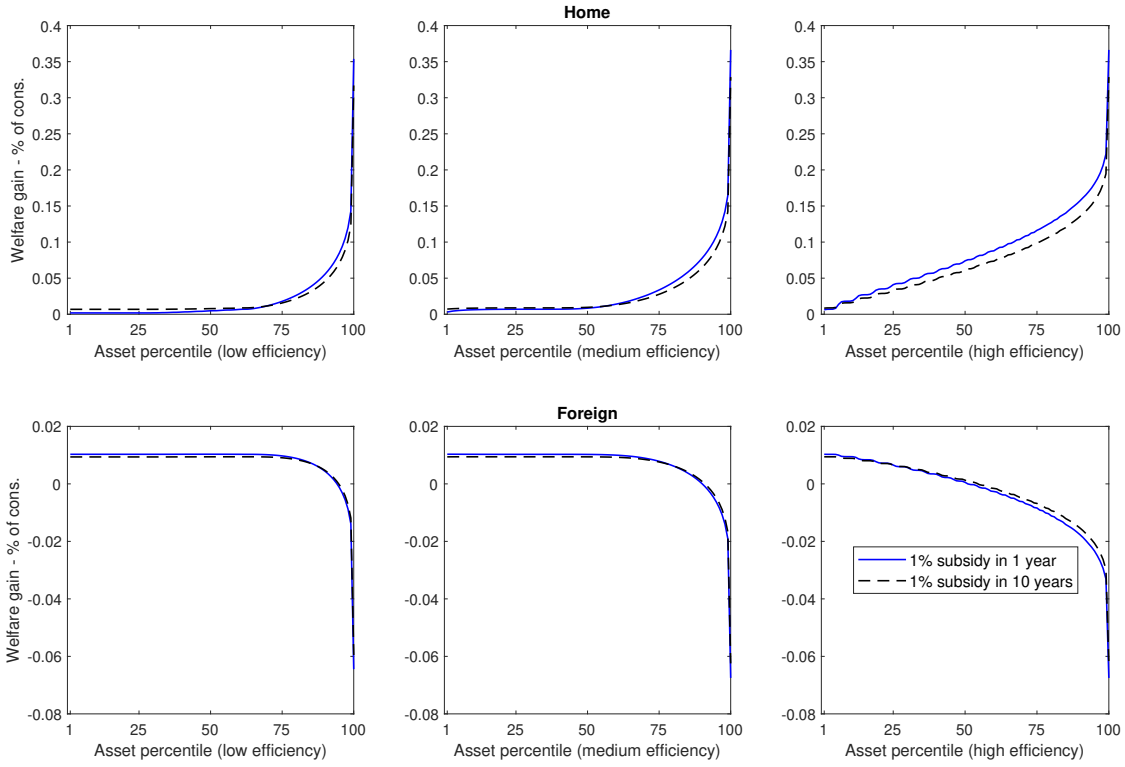

Figure 13: Welfare gains from a 1% subsidy in Home over a 1-year and 10-year period, respectively. The welfare gains for households from each country across asset percentiles (1st poorest-100th richest) as well as low, medium and high labor efficiency levels are plotted, respectively. The welfare gains are calculated relative to financial integration in year 2020 when each policy is implemented.

6 Conclusions

While policymakers often discuss the elimination of global imbalances as a distinct goal, little is known how such policies would impact different groups of households in both the debtor countries (like the United States) and in creditor countries (like China). We have pro-

vided novel normative insights by analyzing the distributional consequences of rebalancing, depending on how the rebalancing is achieved.

We found that the poorest households are likely to benefit if rebalancing is achieved by policies that promote savings in debtor countries, because such policies lead to lower global interest rates and higher wages. Conversely, the poorest households are likely to be worse off if rebalancing is achieved by policies that restrict savings in the creditor countries, because they have the exact opposite impact on the global interest rates and wages.

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A Borrowers and Lenders 2010-2019

Borrowers Czech Republic, North Macedonia, Yemen, Bhutan, Morocco, Nepal, Republic of Congo, Nicaragua, Bolivia, South Africa, Marshall Islands, Lesotho, Australia, Chile, Mozambique, St. Vincent & Grens., Tanzania, Comoros, Antigua and Barbuda, Mauritius, Mali, Sudan, Dem. Rep. of Congo, Togo, Oman, Seychelles, Ethiopia, Uganda, Gambia, Samoa, Burundi, Albania, Grenada, Senegal, Jamaica, Solomon Islands, Slovak Republic, France, Tajikistan, Honduras, United States, Burkina Faso, Ukraine, India, Canada, Georgia, Costa Rica, Moldova, Palau, Algeria, Peru, Panama, Turkmenistan, Montenegro, Tonga, Romania, Niger, St. Kitts and Nevis, Portugal, Zimbabwe, Latvia, Ghana, Guyana, Cameroon, Bosnia and Herzegovina, Kazakhstan, Côte d'Ivoire, Poland, Guatemala, Cape Verde, Equatorial Guinea, Belarus, São Tomé & Príncipe, Lao People's Dem.Rep, United Kingdom, Afghanistan, Guinea, Ireland, Cambodia, Bangladesh, Barbados, Mongolia, Armenia, Mauritania, Brazil, Guinea-Bissau, Kyrgyz Republic, Mexico, El Salvador, Cyprus, Lebanon, Serbia, Tunisia, Central African Rep., Pakistan, Argentina, Liberia, Namibia, Benin, Madagascar, St. Lucia, Dominican Republic, Rwanda, Egypt, Malawi, Sri Lanka, Jordan, Sierra Leone, Colombia, Dominica, Kenya, Haiti, New Zealand, Maldives, Chad, Finland, Indonesia, Tuvalu, Ecuador, Fiji, Belize, Turkey, Greece, Uruguay, Bahamas, Suriname, Myanmar

Lenders Eswatini, Paraguay, Uzbekistan, Malaysia, Qatar, Lithuania, Botswana, Slovenia, Azerbaijan, Italy, Brunei Darussalam, Iran, Netherlands, Bahrain, Thailand, Hungary, Germany, Bulgaria, Nigeria, Libya, China (Mainland), United Arab Emirates, South Korea, Denmark, Norway, Sweden, Estonia, Vietnam, Israel, Kiribati, Japan, Kuwait, Venezuela, Trinidad and Tobago, Malta, Iceland, Austria, Singapore, Djibouti, Timor-Leste, Russia, Croatia, Philippines, Vanuatu, Zambia, Luxembourg, Gabon, Angola, Eritrea, Saudi Arabia, Spain, Hong Kong, Iraq, Micronesia, Belgium, Switzerland, Papua New Guinea

B Equilibrium characterization

1. Firm optimization yields,

$$r_t^k = F_K(K_t, N_t), r_t^{k*} = F_{K^*}(K_t^*, N_t^*), w_t = F_N(K_t, N_t), w_t^* = F_{N^*}(K_t^*, N_t^*)$$

2. Household optimization yields,

$$U_c(c(a_t, \varepsilon_t)) = \beta E_{\varepsilon_{t+1}|\varepsilon_t}[1 + r_{t+1}^w(1 - \tau_{t+1})][U_c(c(a_{t+1}, \varepsilon_{t+1})) + \lambda(a_{t+1}, \varepsilon_{t+1})],$$

$$U_{c^*}(c^*(a_t^*, \varepsilon_t)) = \beta E_{\varepsilon_{t+1}|\varepsilon_t}[1 + r_{t+1}^w(1 - \tau_{t+1}^*)][U_{c^*}(c^*(a_{t+1}^*, \varepsilon_{t+1})) + \lambda^*(a_{t+1}^*, \varepsilon_{t+1})],$$

where λ and λ^* are the multipliers associated with the borrowing constraints in the respective countries. In an equilibrium with financial integration, we obtain

$$r_t^w(1 - \tau_t) = (r_t^k - \delta)(1 - \tau_t)$$

and

$$r_t^w(1 - \tau_t^*) = (r_t^{k*} - \delta)(1 - \tau_t^*),$$

which yields

$$r_t^k = r_t^{k*}.$$

In equilibrium, the rental rates of capital are equalized across two countries. This also implies that the capital-labor ratios, wages, aggregate capital stock and output levels also move together.

As previously mentioned, taxes (subsidies) serve as wedges within each country that distort intertemporal savings decisions.