GRAPE Working Paper #80

Winners and losers from reducing global imbalances

Ayşe Dur and Jacek Rothert

FAME | GRAPE, 2023

Foundation of Admirers and Mavens of Economics
Group for Research in Applied Economics

Winners and losers from reducing global imbalances

Ayşe Dur
North Carolina State University

Jacek Rothert
U.S. Naval Academy
and FAME|GRAPE

Abstract

We analyze the welfare effects of various policies aimed at global rebalancing --- the elimination of persistent current account surpluses and deficits, and/or elimination of large positive and negative net foreign asset positions. Specifically, we study how these policies will affect the welfare of different groups of households, as well as overall wealth inequality within both debtor and creditor countries. We use a two-country version of a workhorse heterogeneous agents framework of Aiyagari (1994), calibrated to the U.S. (largest debtor) and a composite of its trading partners, the Rest of the World (ROW). Our results show that, relative to full financial integration, policies that reduce global imbalances via an increase in U.S. savings rates will lower global interest rates, increase capital-output ratio and total output in both countries. They will improve welfare of the poorest households and reduce wealth inequality in both countries. Conversely, policies that operate via a decrease in ROW's savings will raise global interest rates, reduce the capital-output ratio and total output in both countries. The rise in interest rates will reduce the welfare of the poor households, even though the overall wealth inequality will decline.

Keywords:

Global imbalances, wealth inequality, rebalancing, heterogeneous agents, international capital flows

JEL Classification

E21, F3, F32, F41

Corresponding author

Jacek Rothert, jacek.rothert@gmail.com

Acknowledgements

We thank Andy Glover, as well as participants at the Southern Economic Association meetings, and Midwest Macro meetings for helpful comments. All errors are ours. Jacek Rothert gratefully acknowledges financial support of the National Science Center, Poland, Grant no. 2019/35/B/HS4/00769. The views expressed here are those of the authors and do not represent the views of the United States Naval Academy, the Department of Defense, or the Federal Government.

Published by: FAME | GRAPE
ISSN: 2544-2473

Foundation of Admirers and Mavens of Economics
ull. Mazowiecka 11/14
00-052 Warszaw
Poland

W | grape.org.pl
E | grape@grape.org.pl
TT | GRAPE_ORG
FB | GRAPE.ORG
PH | +48 799 012 202

1 Introduction

The liberalization of international financial flows during the 1970's and early 1980's was followed by an increase in current account imbalances. In 2008, at the onset of the global financial crisis, the sum of total trade surpluses and deficits reached almost 6% of global GDP — the largest fraction recorded in history. The average absolute value of net foreign asset positions relative to GDP has been steadily growing, reaching almost 30% prior to the global financial crisis, and more than 50% in 2020 (Figure 1).

While the mere existence of current account (and trade) imbalances in a financially integrated world is fully consistent with economic theory and should be expected, the magnitudes and persistence of those imbalances attracted good amount of attention from both political and academic circles. The financial crisis of 2008-09 reignited the early arguments that the persistent and large current account imbalances might be undesirable and should be reduced. Arguments raised included "bad" origins, such as domestic distortions leading to high savings and low investment, or credit booms fueled by "poor" government policies rather than by fundamentals, as well as "bad" consequences, such as risk of sudden-stops resulting in a very costly adjustment (Obstfeld, 2004; Obstfeld and Rogoff, 2007; Blanchard and Milesi-Ferretti, 2012). Global imbalances also made their way to the political world, most prominently during the 2016 presidential primaries in the United States - the largest debtor country (Figure 1). In general, the two broad classes of policies discussed in the context of rebalancing relied on either (1) increasing national savings in the deficit economies, or (2) increasing national consumption in the surplus economies (Li and Whalley, 2016; Triggs, 2019).

In this paper we examine the effects of those policies through the lenses of a two-country version of an Aiyagari economy (Aiyagari, 1994) with heterogeneous households and uninsurable idiosyncratic risk, similar to Mendoza et al. (2009b) and Kabukçuoğlu (2017). Within this framework we are able to examine how effective such policies are in reducing the 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.

We find that a one percentage point increase in a savings subsidy in a debtor country

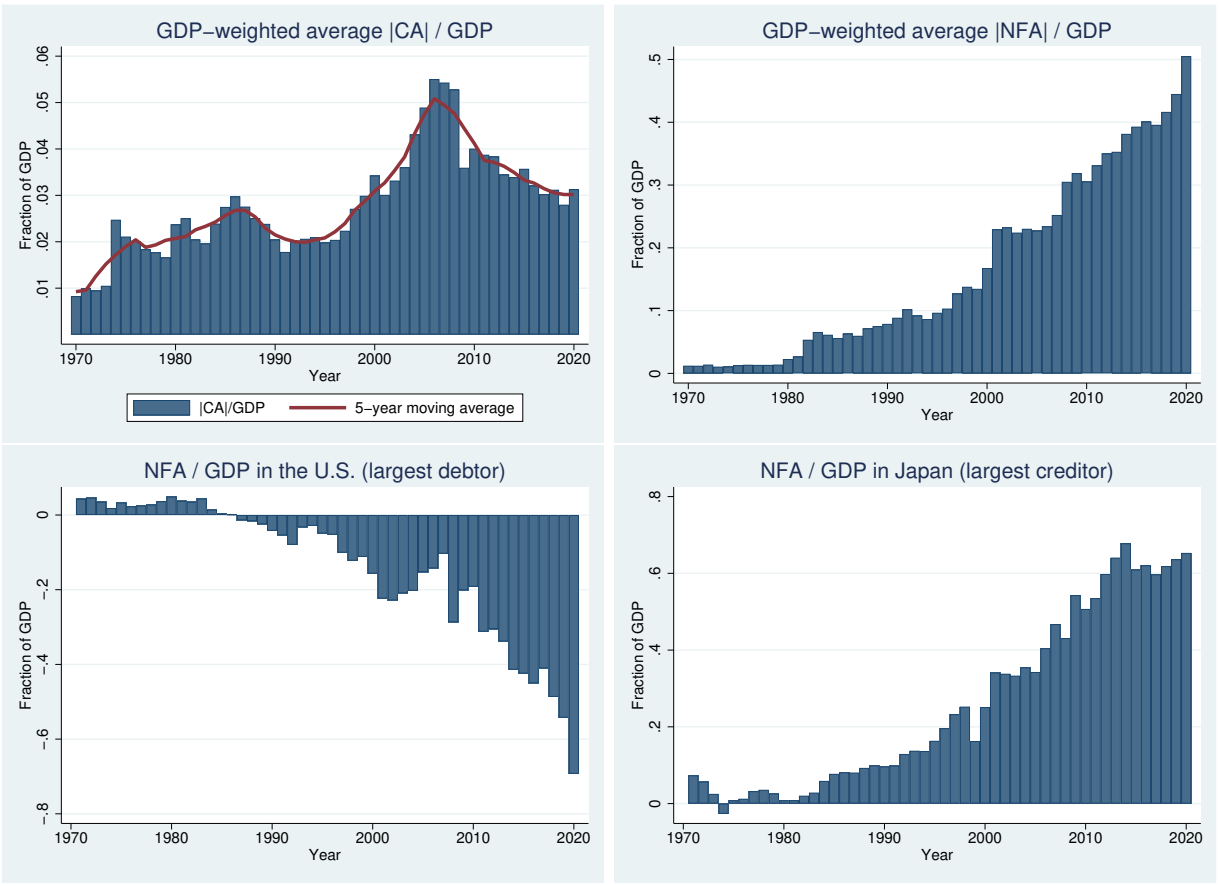

Figure 1: Global imbalances

or a savings tax in the creditor country have a similar long-run impact on the net foreign asset positions and on the wealth distribution within each country. Relative to full financial integration, the ratio of external debt to GDP in the debtor country falls from 32.5% to 26.4% and 26%, respectively. The ratio of external surplus to GDP in the creditor country falls from from 10.4% to 8.4% and 8.3%, respectively. Relative to full financial integration, the two rebalancing policies reduce wealth inequality, but the quantitative impact on wealth distribution is very small.

Welfare effects depend on the way rebalancing is achieved. Relative to full financial integration, a savings subsidy in a debtor country lowers the global interest rate and increases the capital-output ratio, total output, and wages in both countries. This benefits the poor households who have a very low (or even negative) net wealth and rely a great deal on labor income. Conversely, a savings tax in a creditor country increases the global interest rate and reduces the capital-output ratio, total, and wages in both countries. Naturally, this hurts the poorest households in both countries.

We chose to model the policies aimed at rebalancing as either a savings subsidy in the debtor (D) country or a savings tax in the creditor (C) country. Our rationale is based on the accounting identity that relates the current account balance to savings and investment. The persistent global imbalances between the debtor (D) and creditor (C) countries can be summarized as:

$$CA^D \equiv S^D - I^D < 0 < S^C - I^C \equiv CA^C$$

There is a good amount of very suggestive evidence in the literature 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.

1.1 Literature review

The main area of research our paper is related to is on global imbalances—their sources, consequences, and potential ways to be eliminated (see Cooper (2001) or Obstfeld and Rogoff (2007) for early work on this topic). Explanations for the existence of the global imbalances

relied mostly on China's large demand for safe assets driven by precautionary motives (Mendoza et al., 2009b) or limited access to equity markets (Chien and Naknoi, 2015), combined with its inability to generate such assets (Caballero et al., 2008). Kehoe et al. (2018) and Reyes-Heroles (2018) studied the impact the global imbalances on the manufacturing sector in the United States. Contrary to many political arguments, both studies found that only a small percentage of the decline in the manufacturing employment could be attributed the external deficit of the U.S.. Early studies that looked at potential ways to eliminate imbalances used a partial equilibrium approach and focused on the depreciation of the U.S. dollar that would be needed to achieve re-balancing (Obstfeld, 2004). Modern approach relies on general equilibrium models, where the re-balancing is achieved through policy or demographic changes. İmrohoroğlu and Zhao (2018) show that the expected demographic changes in China, combined with an inevitable slow-down of its economic growth would eliminate China's persistent CA surplus. Our main focus is not on *how* re-balancing is achieved. Instead, we force the re-balancing to happen, and then ask: who pays the price?

The literature on the consequences of re-balancing is still scarce and, to the best of our knowledge, our study is the first to address the distributional welfare consequences of re-balancing. Kehoe et al. (2013) show that if re-balancing 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. Li and Whalley (2012) show that re-balancing achieved can be achieved through VAT reforms in both surplus and deficit countries, and that such reforms would be welfare enhancing in all countries involved.

While not our main focus, our analysis of the distributional consequences of gradual vs. sudden rebalancing may be of great interest for the literature on emerging markets business cycles. A salient feature of crises in emerging markets during the 1990s were sharp reversals of current account a.k.a. sudden stops (Reinhart and Calvo, 2000; Edwards, 2005). The role of uninsured risk in a sudden stop prone economy was explored in Durdu et al. (2009). However, they did not consider the distribution of wealth within a country. Instead, they modeled an emerging economy as a small open economy with a stand-in household. That small open economy acted just like an atomistic agent in the Aiyagari economy, taking as given the events in the rest of the world. Our study may be the very first to analyze the

importance of gradual vs. sudden changes in global interest rates in an Aiyagari model.

While global imbalances by construction result from the differences between savings and investment rates across and within countries, our analysis focuses on the savings aspect. This is motivated by a number of very convincing studies that argued the savings channel was the driving force behind the imbalances. Steinberg (2019) performs conduct a wedge accounting analysis of U.S. trade balance and shows that the rise of the global saving supply accounts for more than 90% of the excess U.S. deficit. Broer (2014) shows how the rise in income risk in the U.S. reduces the incentive to default, which allows creditors to relax borrowing limits, leading to current account deficit in an open economy setting. A separate line of literature looked at policies and market imperfections that stimulated savings in China. Michaud and Rothert (2014) interpret China's surplus as a result of optimal policy in the presence of growth (learning-by-doing) externalities—forced households' savings increase labor supply, leading to higher growth and higher permanent income. The empirical analysis in Chamon and Prasad (2010) highlighted an important role of housing, health care, and education expenditures in the growing savings rates of urban households.

Finally, our paper is also related to the large literature on international capital flows, particularly in the context of current account surpluses among the fast growing East-Asian economies (Gourinchas and Jeanne (2013), Rothert (2016)). Gourinchas and Jeanne (2013) showed that the complete pattern of capital flows to developing countries could be accounted for by introducing a savings wedge that is almost perfectly negatively correlated with the productivity growth. Rothert (2016) showed that the same savings wedge reflects the small size rather than the direction of net capital flows.

2 Global imbalances since 1980

We start by documenting certain stylized facts about the evolution of net external positions, current account imbalances, as well as changes in the distribution of wealth within major creditor and debtor countries. Our data on net foreign asset positions, current account balances and nominal GDP is from Lane and Milesi-Ferretti (2018), updated in December

2021[1]. We merge it with the National Income and Product Accounts statistics from the World Bank's World Development Indicators (WDI). Our data on wealth distribution is from the Global World Databook 2019, published by Credit Suisse, and based on selected countries' official surveys and statistics. We provide the details of the data coverage in the Appendix.

2.1 Net external imbalances - magnitude and persistence

Magnitude Figure 1 on page 2 illustrates the growth of imbalances in current accounts and net foreign asset positions since the early 1980s. The global GDP-weighted average of current account surpluses and deficits reached its peak during the 2008-09 financial crisis, and started to decline following the Great Recession. Despite the decline, they stabilized at the level from early 2000's, i.e. from the time when the term "global imbalances" was coined. 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. Hence, in terms of magnitude, global imbalances appear to be alive and well.

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 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 stark difference between the United States and China is probably the most famous illustration of the global imbalances. It is depicted in the left panel of Figure 2. That graph also illustrates the remarkable persistence of the current account imbalances. The U.S. (Chinese) economy has been running a net external deficit (surplus) for more than 20 consecutive years! The right panel of Figure 2 shows that the persistence is not only

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

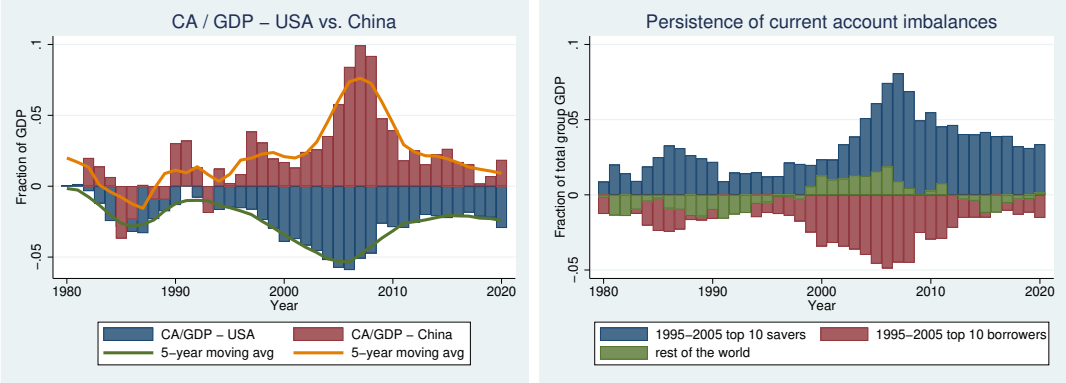

Figure 2: Current account surpluses and deficits

the feature of these two countries. It plots the current account balances of three groups of countries: those that were among the world's top 10 surplus (deficit) economies during the period 1995-2005, as well as the rest of the world. The top 10 surplus economies from the 1995-2005 are still running a sizeable current account surplus, and the top 10 deficit economies from the 1995-2005 are still running a sizeable current account deficit.

2.2 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.

The left and central panels of Figure 3 plots the long-run averages of current account to GDP ratio against savings to GDP ratio, and against investment to GDP ratio, for each country. The correlation between CA/GDP and S/GDP is very high and positive. The correlation between CA/GDP and I/GDP is weaker. Most importantly, however, it is

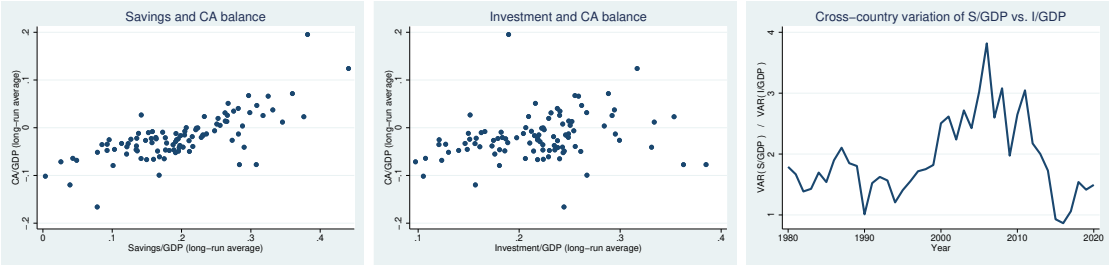

Figure 3: Savings vs. Investment as the drivers of Current Account balances

positive — the opposite of what one would expect, had the differences in CA/GDP were largely driven by differences in I/GDP.

The right panel of Figure 3 explains the reason behind the different strength of the relationship between current account balances and savings vs. investment. The cross-country variation in savings rates is much larger than the cross-country variation in investment rates. Over the last 40 years, only in 2015 and in 2016 did we see the variance of investment rates across countries be higher than the variance of the savings rates. Otherwise, it is the savings behavior that differs the most across countries, hence driving the differences in current account balances.

2.3 Wealth Inequality

Finally, we document empirical patterns on the evolution of wealth inequality across surplus and deficit economies, because we believe it is important to get a sense of possible differences in the evolution of wealth distribution between the surplus and deficit economies. Our analysis focuses on the role of the savings margin in both the emergence of global imbalances and in their reduction. In a framework with uninsurable idiosyncratic risk that we will use in the next section, any policy that operates via a savings margin will naturally have an impact on the distribution of wealth within each country.

The comparison is tricky, since the documented increase in wealth inequality is a common feature of a large number of countries. Moreover, a reliable data on wealth inequality that would be comparable across countries is not easily available. Therefore, the analysis we provide here should be interpreted as illustrating certain patterns in the data, to the extent

allowed by data limitations.

Data limitations We are facing a few roadblocks related to data availability. First, there are huge differences between countries regarding the frequency with which data on wealth distribution is published. For example, in Australia the data is published every two years, in Spain every three, and in Germany every five. Second, countries differ in the type of assets that are included in the measurement of wealth. Some countries, e.g. Japan, only consider financial wealth (Kitao and Yamada, 2019), while others, e.g. Germany, also include real estate (Fuchs-Schundeln et al., 2009). Third, the statistics reported vary across countries (some countries provide data by deciles, others only report quintiles; some countries provide share of wealth held by 1%, others do not). Finally, the unit at which the data is collected may also differ. While in most countries that unit is a household, there are a few instances when that unit is a person.

Due to the limitations described above, comparison of the wealth inequality data between countries in any given year appears problematic. However, we can draw some conclusions from the observed *changes* in wealth inequality, under the assumptions that the unobservable cross-country heterogeneity in the measurement of wealth inequality remained unchanged.

Changes in wealth inequality and changes in Net Foreign Assets We use data on wealth inequality reported in Global Wealth Databook 2019, published by Credit Suisse, and based on selected countries' reports on the distribution of financial and non-financial assets. We consider seven measures of wealth inequality that had the largest cross-country coverage: the fraction of wealth held by top 50, 40, 30, 20, 10, 5, and 1 percent of the population. For each country, we first calculate the change in all available measures of wealth inequality over the longest possible time horizon. Next, over that same time horizon, we calculate for each country the change in the ratio of net foreign asset position to GDP. We then look at the cross-country correlation between the changes in a particular measure of wealth inequality and the change in net foreign asset position, by running the following simple regression (seven times, for each measure of inequality):

$$\Delta \texttt{NFA/GDP}_i = \beta_0 + \beta_1 \Delta \texttt{Wealth\_Ineq}_i + \epsilon_i \tag{2.1}$$

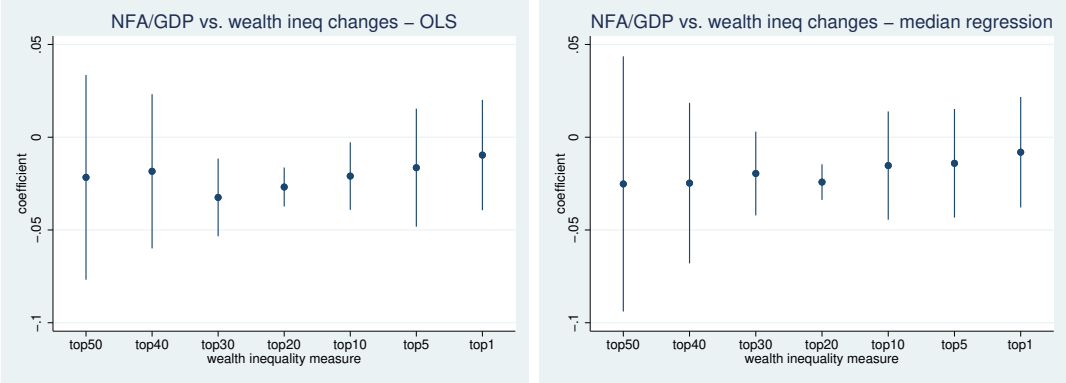

Figure 4: Δ NFA/GDP vs. Δ Wealth Inequality
Coefficients from the cross-country regression $\Delta\texttt{NFA/GDP}_i = \beta_0 + \beta_1 \Delta\texttt{Wealth\_Ineq}_i + \epsilon_i$. Different measures of `Wealth_Ineq` on the horizontal axis: top$X$ means fraction of wealth held by top X% of the population. Left panel: OLS; Right panel: median regression.

where i denotes a country. Since we end up with very few observations (around 20), our results are very sensitive to outliers. Hence, we decided to report the results from both linear and median regressions of the changes in net foreign asset positions (relative to GDP) on changes in wealth inequality. Figure 4 plots the coefficients β_1 from regressions (2.1). Overall, if any, the relationship between the change in net foreign position and the change in wealth inequality appears to lean towards negative: countries that ran current account surpluses tended to experience a smaller increase in wealth inequality.

3 Model

Our 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).

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.

3.1 Households

Households' expected life-time utility is given by,

$$E_0 \left[\sum_{t=0}^{\infty} \beta^t \log(c_t) \right] \tag{3.1}$$

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,

$$c_t + b_{t+1} + k_{t+1} = \varepsilon_t n w_t + [(1-\tau_t)(r_t^k - \delta) + 1]k_t + [(1-\tau_t)r_t^w + 1]b_t + Tr_t, \tag{3.2}$$

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.[2] 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

[2]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).

alone we assume the proceeds of those taxes are reimbursed in a lump 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 (this assumption can be relaxed later on), 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:

$$b_t + k_t = \underline{a}. \tag{3.3}$$

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

Constraints (3.2) and (3.3) 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:

$$r_t^w = r_t^k - \delta \tag{3.4}$$

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+1} where

$$a_{t+1} \equiv b_{t+1} + k_{t+1},$$

we can rewrite the period budget constraint,

$$c_t + a_{t+1} = \varepsilon_t n w_t + [1 + (1 - \tau_t) r_t^w] a_t + T r_t \tag{3.5}$$

and borrowing constraint,

$$a_t = \underline{a}. \tag{3.6}$$

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 (3.1) subject to (3.5) and (3.6). 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 Firms

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

$$Y_t = F(K_t, N). \tag{3.7}$$

Firm's profits can be written as

$$F(K_t, N) - r_t^k K_t - w_t N \tag{3.8}$$

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.

3.3 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

$$g_{t+1}(a_{t+1}, \varepsilon_{t+1}) = \sum_{\varepsilon_{t+1}} \Pi(\varepsilon_{t+1}|\varepsilon_t) g_t(f_a^{-1}(a_{t+1}, \varepsilon_t), \varepsilon_t). \tag{3.9}$$

We describe the equilibrium under financial integration as follows.

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,

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

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

(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:

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

(v) Government budget holds:

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

(v) 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,

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

Foreign variables can be defined similarly.

3.4 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

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

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

4 Quantitative analysis

We calibrate the two countries to the U.S. and Rest of the World (ROW)[3]. 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, and total factor productivity levels, therefore country size. Second, we aim to match the highly concentrated wealth distribution for Borrowers (the US). For Lenders, while we adopt the same labor income shock process as the one we use for Borrowers, 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, $Y = ZK_t^{\alpha}N_t^{1-\alpha}$. 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.:

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

[3]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.

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 Aiyagari-type 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 parameters 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.

While the income shock process is calibrated to match a realistic overall wealth distribution for the US, we follow the same calibration for the ROW parameters which do not have a target for comparison. Finally, we set the borrowing limit for Lenders 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.

Table 1: Calibration

	Borrowers (US)	Lenders (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

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.

Quantitative experiments. We start from year 1990 when Borrowers and Lenders 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 Borrowers and Lenders. Then, in year 2020, we study two scenarios: the enaction of a one percent subsidy on asset returns in Borrowers, and the enaction of a one percent tax on asset returns in Lenders. The two scenarios, depicted in Figure 5, capture two different policies aimed at reducing the extent of global imbalances. The first one tries to increase savings in the Borrowing country, while the second one tries to increase consumption in the Lending country. Both involve unanticipated and permanent policies.

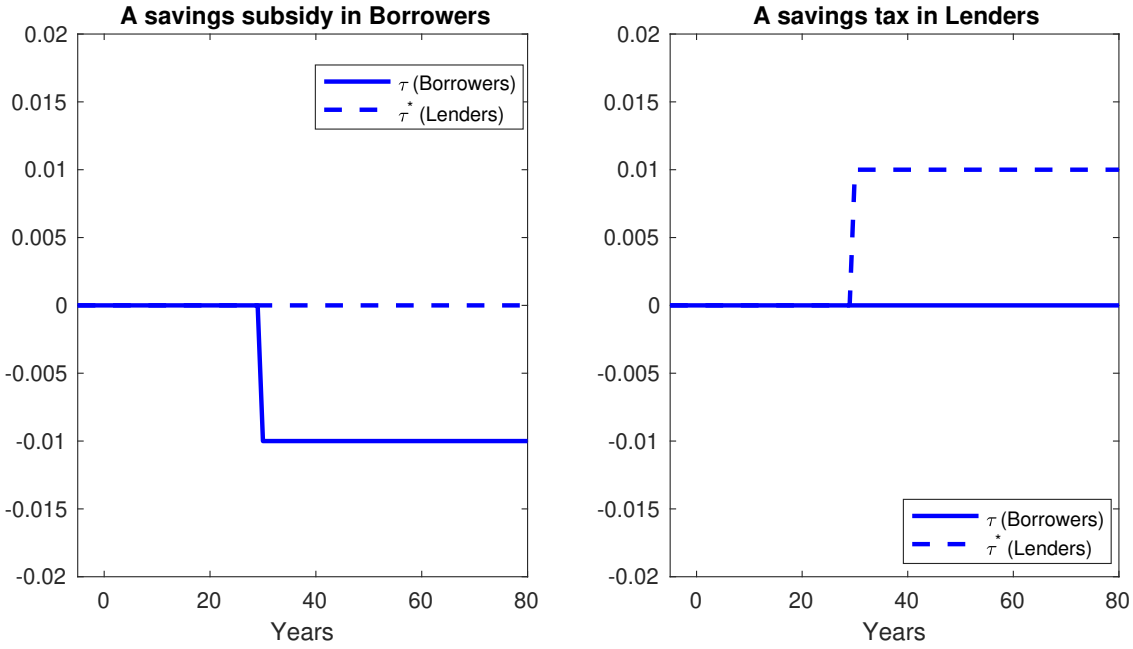

Figure 5: Scenario 1 (left panel): Introducing a one percent savings subsidy in Borrowers. Scenario 2 (right panel): Introducing a one percent savings tax in Lenders

Table 2: Financial autarky steady state

Allocations and prices		
	Borrowers	Lenders
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			
	Borrowers		Lenders
Asset holdings (%)	Model	Data	Model
$q1$ (poorest 20%)	-1.6	-0.2	0.9
$q2$ (20% – 40%)	-0.6	1.1	1.6
$q3$ (40% – 60%)	1.3	4.5	2.8
$q4$ (60% – 80%)	17.5	11.2	16.4
$q5$ (richest 20%)	83.4	83.4	78.4
Wealth Gini	0.82	0.82	0.74

4.1 Results

We will split the discussion of our results into two parts. We will first discuss how rebalancing affects major aggregates as well as distribution of wealth in the long-run. We will then describe how the two economies transition towards that new steady-state.

4.1.1 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 Borrowers' asset returns (called Rebalancing 1), and under rebalancing due to a tax on Lenders' 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 Borrowers reaches 32.5% of GDP and the net external surplus of the Lenders 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 Borrowers and Lenders (Mendoza et al. (2007, 2009b)). With financial integration, Borrowers 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. Lenders 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 integration increases the wealth inequality in the Borrowing country and reduces it in the Lending country as indicated by the respective change in the Gini coefficients for wealth. This is consistent with the empirical patterns presented in Section 2.3 — countries that experienced a more positive change in net foreign asset position tended to experience a smaller increase in wealth inequality.

Scenario 1: A savings subsidy in Borrowers under financial integration. A one percent subsidy in Borrowers' asset returns (Relabancing 1) causes a further accumulation of capital, not only in Borrowers but also in Lenders. This leads to an output and wage growth

(albeit small) in both countries and drives the world interest rate down. Consistent with its goal, this subsidy also deters international borrowing by Borrowers, and the net foreign asset-to-GDP ratio for Borrowers (Lenders) shrinks to -26.4% (10.4%).

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

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

% change relative to fin. autarky	Borrowers (US)			Lenders (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 $(\%\ pt)$	-0.05	-0.06	-0.04	0.02	0.01	0.03
w	0.3	0.3	0.3	-0.1	-0.1	-0.2

Table 4 shows the results on long-run wealth distributions. Accordingly, financial integration leads to greater wealth inequality for Borrowers 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, for Lenders the Gini coefficient changes from 0.74 to 0.73, resulting in lower wealth inequality.

Introducing a subsidy in Borrowers improve the outcome in favor of the poor in both countries. The Gini coefficient goes down to 0.81 and 0.72 in Borrowers and Lenders, respectively.

Scenario 2: A savings tax in Lenders under financial integration. In terms of the resulting imbalances in the net foreign asset positions, a one percent tax on asset returns in Lenders helps achieve a similar result as Scenario 1 with a one percent subsidy on asset returns in Borrowers (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, Lenders would want to save less, both in capital and bonds, implying higher interest rates in

equilibrium. Borrowers also reduce their capital stock consistent with a higher world interest rate. Output and wages in both countries move in the same direction as capital and decrease.

For Lenders, trying to reduce the NFA imbalances amplifies the negative effects of financial integration on capital and output. For Borrowers, 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 Sceniario 1 (Rebalancing 1) and there is lower wealth inequality relative to financial integration. The Wealth Gini coefficients are 0.81 and 0.72, respectively.

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

	Borrowers (US)			Lenders (ROW)		
Quintiles	Integration	Rebalancing 1	Rebalancing 2	Integration	Rebalancing 1	Rebalancing 2
$q1$ (poorest 20%)	-1.9	-1.9	-1.9	0.9	0.9	0.9
$q2$ (20% – 40%)	-1.0	-1.0	-1.0	1.6	1.6	1.6
$q3$ (40% – 60%)	0.5	0.7	0.7	2.9	2.9	2.9
$q4$ (60% – 80%)	16.4	16.7	16.7	16.7	16.7	16.7
$q5$ (richest 20%)	86.0	85.5	85.5	77.9	78.0	78.0
Wealth Gini	0.84	0.81	0.81	0.73	0.72	0.72

5 Conclusions

While the elimination of global imbalances has often been called for in policymakers' circles, 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). In this paper we wanted to shed some light on this questions by analyzing the distributional consequences of rebalancing, paying particular attention to how those consequences depend on the manner in which rebalancing is achieved.

In general, we found that the poorest households are likely to benefit if rebalancing is achieved by policies that promote savings in the 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, that have the exact opposite impact on the global interest rates and wages.

References

Aiyagari, S. R. (1994): "Uninsured Idiosyncratic Risk and Aggregate Saving*," *The Quarterly Journal of Economics*, 109, 659–684.

Blanchard, O. and G. M. Milesi-Ferretti (2012): "(Why) Should Current Account Balances Be Reduced?," *IMF Economic Review*, 60, 139–150.

Broer, T. (2014): "Domestic or global imbalances? Rising income risk and the fall in the US current account," *Journal of Monetary Economics*, 64, 47–67.

Caballero, R. J., E. Farhi, and P.-O. Gourinchas (2008): "An Equilibrium Model of "Global Imbalances" and Low Interest Rates," *American Economic Review*, 98, 358–393.

Chamon, M. D. and E. S. Prasad (2010): "Why Are Saving Rates of Urban Households in China Rising?" *American Economic Journal: Macroeconomics*, 2, 93–130.

Chari, V. V., P. J. Kehoe, and E. R. McGrattan (2007): "Business Cycle Accounting," *Econometrica*, 75, 781–836.

Chien, Y. and K. Naknoi (2015): "The risk premium and long-run global imbalances," *Journal of Monetary Economics*, 76, 299–315.

Cooper, R. N. (2001): "Is the U.S. Current Account Deficit Sustainable? Will It Be Sustained?" *Brookings Papers on Economic Activity*, 32, 217–226.

Domeij, D. and J. Heathcote (2004): "On the distributional effects of reducing capital taxes," *International economic review*, 45, 523–554.

Durdu, C. B., E. G. Mendoza, and M. E. Terrones (2009): "Precautionary demand for foreign assets in Sudden Stop economies: An assessment of the New Mercantilism," *Journal of Development Economics*, 89, 194–209.

Edwards, S. (2005): "Capital Controls, Sudden Stops and Current Account Reversals," NBER Working Papers 11170, National Bureau of Economic Research, Inc.

Fuchs-Schundeln, N., D. Krueger, and M. Sommer (2009): "Inequality Trends for Germany in the Last Two Decades: A Tale of Two Countries," Working Paper 15059, National Bureau of Economic Research.

Gourinchas, P.-O. and O. Jeanne (2013): "Capital Flows to Developing Countries: The Allocation Puzzle," *Review of Economic Studies*, 80, 1484–1515.

İmrohoroğlu, A. and K. Zhao (2018): "Household Saving, Financial Constraints, and the Current Account in China," Working papers 2018-15, University of Connecticut, Department of Economics.

Kabukçuoğlu, A. (2017): "The winners and losers of tax reform: An assessment under financial integration," *Journal of Economic Dynamics and Control*, 85, 90 – 122.

Kehoe, T. J., K. J. Ruhl, and J. Steinberg (2013): "What will happen when foreigners stop lending to the United States?" Economic Policy Paper 13-4, Federal Reserve Bank of Minneapolis.

Kehoe, T. J., K. J. Ruhl, and J. B. Steinberg (2018): "Global Imbalances and Structural Change in the United States," *Journal of Political Economy*, 126, 761–796.

Kitao, S. and T. Yamada (2019): "Dimensions of inequality in Japan: Distributions of earnings, income and wealth between 1984 and 2014," CAMA Working Papers 2019-36, Centre for Applied Macroeconomic Analysis, Crawford School of Public Policy, The Australian National University.

Lane, P. R. and G. M. Milesi-Ferretti (2018): "The External Wealth of Nations Revisited: International Financial Integration in the Aftermath of the Global Financial Crisis," *IMF Economic Review*, 66, 189–222.

Li, C. and J. Whalley (2012): "Indirect Tax Initiatives and Global Rebalancing," Working Paper 17919, National Bureau of Economic Research.

——— (2016): "Indirect Tax Initiatives and Global Rebalancing," *CESifo Economic Studies*, 63, 24–44.

Mendoza, E. G., V. Quadrini, and J.-V. Ríos-Rull (2009a): "On the Welfare Implications of Financial Globalization without Financial Development," in *NBER International Seminar on Macroeconomics 2007*, National Bureau of Economic Research, Inc, NBER Chapters, 283–312.

Mendoza, E. G., V. Quadrini, J.-V. Rios-Rull, G. Corsetti, and M. Yorukoglu (2007): "On the welfare implications of financial globalization without financial development [with comments]," in *NBER International Seminar on Macroeconomics*, The University of Chicago Press Chicago, IL, vol. 2007, 283–322.

Mendoza, E. G., V. Quadrini, and J. Ríos-Rull (2009b): "Financial Integration, Financial Development, and Global Imbalances," *Journal of Political Economy*, 117, 371–416.

Michaud, A. and J. Rothert (2014): "Optimal borrowing constraints and growth in a small open economy," *Journal of International Economics*, 94, 326 – 340.

Obstfeld, M. (2004): "External adjustment," *Review of World Economics (Weltwirtschaftliches Archiv)*, 140, 541–568.

Obstfeld, M. and K. Rogoff (2007): "The Unsustainable U.S. Current Account Position Revisited," in *G7 Current Account Imbalances: Sustainability and Adjustment*, National Bureau of Economic Research, Inc, NBER Chapters, 339–376.

Reinhart, C. and G. Calvo (2000): "When Capital Inflows Come to a Sudden Stop: Consequences and Policy Options," MPRA Paper 6982, University Library of Munich, Germany.

Reyes-Heroles, R. (2018): "Globalization and Structural Change in the United States: A Quantitative Assessment," 2018 Meeting Papers 1027, Society for Economic Dynamics.

Rothert, J. (2016): "On the savings wedge in international capital flows," *Economics Letters*, 145, 126 – 129.

Rothert, J. and J. Short (2023): "Non-Traded Goods, Factor Markets Frictions, and International Capital Flows," *Review of Economic Dynamics*, 48, 158–177.

Steinberg, J. (2019): "On the Source of U.S. Trade Deficits: Global Saving Glut or Domestic Saving Drought?" *Review of Economic Dynamics*, 31, 200–223.

Triggs, A. (2019): "Rebalancing a lop-sided global economy: Reducing global current account imbalances," *The World Economy*, 42, 3188–3234.