

# Income Inequality and Current Account Imbalances\*

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December 6, 2012

## ABSTRACT

Econometric evidence shows that when higher income inequality and financial liberalization are added to a set of conventional explanatory variables, they predict significantly larger current account deficits in a cross-section of advanced economies. To study this mechanism, we develop a DSGE model where investors' income share increases at the expense of workers, and where workers respond by obtaining loans from domestic and foreign investors. This supports aggregate demand but generates current account deficits, especially if domestic financial markets are simultaneously liberalized. In emerging markets, because domestic workers cannot borrow, investors deploy their surplus funds abroad, leading to current account surpluses.

*Keywords:* Current account imbalances; income inequality; financial liberalization

*JEL Classifications:* E2, F32, F41

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## 1 INTRODUCTION

Global current account imbalances were a major source of financial sector fragility in the run-up to the 2007 worldwide financial crisis. Several authors, including Obstfeld and Rogoff (2009), Blanchard and Milesi-Ferretti (2009), Portes (2009) and Caballero et al. (2008), either partly attribute the crisis to the amplification effects of large current account imbalances and low world real interest rates, or suggest that the root causes of global current account imbalances and the financial crisis coincide.<sup>1</sup> For U.S. current account deficits, the pre-crisis concern centered on the possibility of a run on the U.S. dollar and the danger of the dollar losing its status as the world's reserve currency.<sup>2</sup> While this has not happened, the perception that it is still possible arguably continues to contribute to financial vulnerability worldwide. Competing explanations for U.S. current account deficits include low public and private saving rates in the United States,<sup>3</sup> high saving rates in the rest of the world [Bernanke (2005)], global underinvestment [Prasad et al. (2007); Rajan (2010)], demographics and productivity [Feroli (2003); Ferrero (2007)], and the role of the U.S. dollar as the world's reserve currency. But the phenomenon of persistently high current account deficits is not limited to the United States. We also observe deficits in a number of other developed economies, especially those in the English-speaking world. By studying the similarities between these countries' experiences, and their differences to surplus countries, we make progress toward explaining the deeper structural reasons for persistently large current account deficits.

We argue in this paper that what unites the experiences of most of the deficit countries is a steep increase in income inequality over recent decades. Furthermore, the higher income inequality has been both a consequence and a cause of liberalization in domestic financial markets.<sup>4</sup> For the United States, the empirical evidence in Philippon (2008) and Philippon and Reshef (2009) shows that a substantial part of the observed increase in inequality was due to steeply increasing incomes in the financial sector following domestic financial liberalization. Rajan (2010) argues that greater income inequality in turn led to even more financial liberalization, to allow politicians to be seen as helping lower and middle income groups whose real incomes were stagnating. Watson (2008) provides similar evidence for the United Kingdom, indicating that the British government actively facilitated mortgage financing for the low- and middle-income groups. Although this implies that income inequality and domestic financial liberalization are closely linked, we introduce separate empirical proxies and theoretical shocks to capture their effects in our work. We find that both exhibit a clear empirical and theoretical link to deteriorations in the respective countries' current accounts.

Our data and cross-country econometric analysis shows that increases in income inequality, measured by top income shares, accounts for a very large part of the observed current account deteriorations in countries like the United States or the United Kingdom, and that this result is very robust to the inclusion of other control variables. An empirical proxy for domestic financial liberalization accounts for another substantial part of observed current account deficits.

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<sup>1</sup>Other reasons for the crisis mentioned in the literature include excessive financial liberalization [Keys et al. (2010)] and excessively loose monetary policy either in the United States [Taylor (2009)] or globally [Bank for International Settlements (2008)].

<sup>2</sup>See Obstfeld and Rogoff (2001), Roubini and Setser (2004), Mann (2004) and Mussa (2004).

<sup>3</sup>The theoretical case for the link between low public saving rates and current account deficits is made in Kumhof and Laxton (2010). Empirical evidence is provided in Bluedorn and Leigh (2011).

<sup>4</sup>Throughout this paper our focus is on financial liberalizations that make it easier to access credit domestically, rather than on liberalizations of access to international financial markets.

Our theoretical analysis is designed to help us understand these empirical results. We lay out a dynamic stochastic general equilibrium (DSGE) model where current account deficits arise endogenously in response to higher domestic income inequality. The model features two distinct household groups. The poor and middle class, who are assumed to not have direct access to international capital markets, start to borrow from the rich, through the financial sector, when they receive a smaller share of aggregate output. Thus, the drop in poor/middle class consumption is less than the drop in their income, while consumption, real investment, and especially financial investment of the rich increase steeply. The rich exhibit home bias in financial assets, due to the monetary/liquidity characteristics of domestic currency assets. The increase in their lending therefore involves an increase in domestic currency loans that is financed in part by borrowing more from abroad. In other words, the country exhibits a capital account surplus and thus a current account deficit. However, this deficit is fairly small relative to what has been observed empirically.

Domestic financial liberalization, by reducing the cost of financial intermediation, initially provides a strong additional stimulus to aggregate consumption by temporarily preventing a large drop in the consumption of poor and middle class households, but at the expense of much larger current account deficits. Furthermore, the longer-run effects include much higher domestic debt levels and debt service, and therefore lower consumption among borrowers. Financial liberalization also slows down capital accumulation, as investors increasingly prefer financial over real assets. Finally, given the evidence in Philippon and Reshef (2009), it can create a vicious cycle by becoming a source for yet more income inequality.

Our theoretical analysis also examines emerging economies, many of which have experienced rising income inequality accompanied by current account surpluses rather than deficits.<sup>5</sup> We find that their large surpluses can also be explained by increases in income inequality. But in this case this is against the background of domestic financial markets that do not allow the poor and middle class to respond to lower incomes by borrowing, leading the rich to invest a large part of their income gains in foreign rather than domestic financial assets.

Our work builds on Kumhof and Ranci re (2010), who show that for the United States there is a striking similarity between the pre-crisis periods of the Great Depression and the Great Recession. Both periods exhibited a simultaneous increase in income inequality and in the indebtedness of the poor and middle class. The perception that household indebtedness had become unsustainably high was a key factor that contributed to eventually triggering these crises. Kumhof and Ranci re (2010) present a DSGE model where an inequality-driven financial crisis arises endogenously. High leverage occurs several decades after the onset of a persistent shock to relative incomes that favors high income households at the expense of all remaining households. This shock increases credit demand at the bottom of the income distribution due to a consumption smoothing motive. At the same time, and much more importantly, it increases credit supply at the top of the income distribution due to a wealth accumulation motive as in Carroll (2000). In other words, high income households recycle their gains from the bargaining process back to poor and middle income households through interest-bearing loans that grow over a period of decades.

Kumhof and Ranci re (2010) replicate several important U.S. stylized facts, including a sharply increasing debt-to-income ratio of the bottom 95% of the income distribution and a rapidly growing financial sector [Philippon (2008)]. However, two of the predictions of their model are counterfac-

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<sup>5</sup>The available data on top income shares are at this point insufficient to carry out a full empirical analysis for emerging economies.

tual, and both are due to the choice of a closed economy setting and to abstracting from domestic financial liberalization. First, the model predicts a collapse in aggregate consumption that is driven by poor and middle class households. This is in contrast to the U.S. credit-fueled consumption boom, which was significantly financed through foreign savings. Second, the model predicts an increase in real interest rates, which is contrary to the data. This again abstracts from the interest-rate lowering effects of foreign savings, but it also abstracts from domestic financial liberalization, which contributed to lower U.S. interest rates and further fueled the credit and consumption boom. This paper extends the framework of Kumhof and Rancière (2010) to an open economy setting and adds financial liberalization shocks, which addresses both of these concerns.

The rest of the paper is organized as follows. [Section 2](#) discusses the pertinent empirical and theoretical literatures. [Section 3](#) discusses the stylized facts, and then presents an econometric panel data analysis of current account determinants that adds proxies for income inequality and domestic financial liberalization to a standard set of regressors. [Section 4](#) develops a DSGE model that is designed to help us understand the empirical results. [Section 5](#) presents model simulations that study the effects of increasing income inequality and increasing domestic financial liberalization. [Section 6](#) concludes.

## 2 RELATED LITERATURE

This section discusses the literature that is relevant to different aspects of our work. We begin with a survey of the empirical literature and then turn to the theoretical literature.

[2.1 EMPIRICAL LITERATURE](#) The empirical literature on the distribution of income and wealth focuses on describing long-run changes in the data [Piketty and Saez (2003), Piketty (2010), Atkinson et al. (2011)]. This literature concludes that the most significant change in most countries' income distribution has been a sharp increase in top income shares. Our theoretical model reflects this feature by studying the interactions between two types of agents that represent the top 5% and the bottom 95% of the income distribution.

A small policy-oriented literature has tried to connect growing income inequality to growing household indebtedness and to the U.S. origins of the financial crisis of 2007/8, most prominently Rajan (2010) and Reich (2010).<sup>6</sup> Both authors suggest that increases in borrowing have enabled the U.S. poor and middle class to maintain or increase their level of consumption while their real earnings stalled. However, this literature has so far limited itself to presenting stylized facts without interpreting them through the prism of a general equilibrium model. One consequence has been an ongoing debate as to whether the increase in credit was mainly driven by credit demand or credit supply. Kumhof and Rancière (2010) provide a general equilibrium model, and show that a shock to the income distribution must imply a simultaneous increase in both credit demand and credit supply, but with a more important role for credit supply, especially when the income shock is persistent.

Atkinson et al. (2011) document that the rise in top income shares over recent decades has been widespread. It has been observed not only in the United States but also in major English-speaking countries (Australia, Canada, New Zealand, United Kingdom) since the early 1980s, and, to a lesser extent and more recently, in some Nordic and peripheral European countries. In this paper,

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<sup>6</sup>Berg and Ostry (2008) find, in a cross-section of countries, that countries with greater inequality exhibit growth spells that are more frequently interrupted by growth breakdowns.

building on the work of Lebarz (2011), we document that these same countries also exhibited high and growing levels of household debt and growing current account deficits that are systematically related to higher income inequality. Moreover, the same countries exhibited domestic financial liberalizations during this period.

There is a large literature that seeks to determine the fundamental factors that have shaped observed changes in the income distribution over the last thirty years, both in the United States and in other countries. These factors, apart from the already mentioned financial liberalization, include increases in returns to education and increased use of performance pay [Lemieux et al. (2009), Lemieux (2006)], changes in unionization [Card et al. (2004)], foreign competition and jobs offshoring [Roberts (2010)], and government intervention in support of the rich [Hacker and Pierson (2010)]. We do not need to take a stand on a preferred explanation. Instead, we take the change in bargaining power over income as a primitive shock and explore its macroeconomic implications, similar to the approach of Blanchard and Giavazzi (2003).

The empirical literature on current account determinants is of course also relevant to our work. We review it in the context of discussing our empirical specifications.

**2.2 THEORETICAL LITERATURE** Three strands of the theoretical literature are relevant to our paper. The financial accelerator literature applied to household debt and housing cycles has so far focused on the role of heterogeneity between patient and impatient households [Iacoviello (2005)]. In these models some households are wealthier than others because they are more patient, while in our model they are wealthier because they attach a greater value to being wealthy. Specifically, they derive utility from wealth, as in Carroll (2000). We see our analysis as complementing the financial accelerator literature, by focussing on the empirically well-documented heterogeneity in incomes, rather than heterogeneity in patience, across households.

The theoretical literature on idiosyncratic income inequality [Krueger and Perri (2006), Iacoviello (2008)] relates income inequality to increases in household debt by showing that an increase in the variance of idiosyncratic income shocks across all households generates a higher demand for insurance through credit markets. Broer (2009) extends that work to the open economy setting and finds that a rise in individual risk in the United States makes default on foreign borrowing less attractive, which allows higher household foreign borrowing against future income. This mechanism can operate alongside the mechanism we study in this paper, which is based on highly persistent income inequality across two specific household groups instead of idiosyncratic and less persistent income shocks across all households.<sup>7</sup> We find that our model, when calibrated to the United Kingdom, matches the observed increase in the debt-to-income ratio of the bottom 95% of the income distribution by matching the change in the income share of the bottom 95%.

Finally, Caballero et al. (2008) and Mendoza et al. (2007) discuss the role of cross-country differences in financial development in explaining current account dynamics. Both conclude that advanced economies with deeper financial markets, such as the United States, will run current account deficits, while economies with less developed financial markets will run current account surpluses. While there are similarities in the outcomes, our analysis differs substantially from these papers. First, financial liberalization is not necessary for current account deficits to develop in our model, income inequality alone is sufficient. Second, in our model economies with a higher level of

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<sup>7</sup>On the question of the persistence of income shocks, the recent work of Kopczuk et al. (2010) shows that the increase in the variance of U.S. annual earnings observed since the 1970 reflects an increase in the variance of permanent rather than transitory earnings.

financial development need not have current account deficits, but countries that further liberalize their domestic financial markets experience current account deteriorations. Third, in our model changes in domestic conditions lead to increased current account deficits, rather than changes in the foreign supply of savings. Fourth, in these papers the capitalization of claims to real output in advanced economies plays a critical role, while in our paper the only claims that are traded are debt claims. Furthermore, in our paper these claims are generated by a combination of a deterioration in income inequality and easier access to credit in domestic financial markets, rather than by a superior financial infrastructure and access to that infrastructure by foreign investors.

### 3 DATA AND ECONOMETRIC RESULTS

In [Section 3.1](#) we document that over the last three decades the majority of the world's industrialized countries has experienced sizeable increases in income inequality. [Sections 3.2](#) and [3.3](#) document, for the same group of countries, the evolution of household indebtedness and of current account imbalances. [Section 3.4](#) presents econometric estimates of current account regressions that add income inequality and domestic financial liberalization to a common list of explanatory variables.

**3.1 RISE IN GLOBAL INCOME INEQUALITY** This paper quantifies income inequality as the share of aggregate income going to the top 5% of the population, ordered by income. A number of research projects have studied the evolution of top income shares for over 20 countries. This work is documented in Atkinson et al. (2011), in a two-volume book by Atkinson and Piketty (2007, 2010), and in the world top incomes database.<sup>8</sup> Atkinson et al. (2011) show that most countries' top income shares declined in the first part of the 20th century, mainly because of negative shocks to top capital incomes during the World Wars and the Great Depression. At that time, top incomes mostly consisted of capital income. Top incomes did not start to rise again for two to three decades following World War II. Globally, [figure 1](#) shows that top 5% income shares followed a U-shape in the remainder of the twentieth century, with declines during the immediate post-war decades followed by increases in recent decades (the pattern for top 1% income shares looks very similar). However, the curvature of the U-shape varies considerably across countries. Starting in the early 1980s, top income shares increased substantially for the United States, the United Kingdom, Canada, Australia, Ireland and New Zealand (U-shape). Moderate or late increases (L/U-shape) were seen in Southern Europe (Spain, Portugal, Italy) and the Nordic countries (Sweden, Finland, Norway), and small or no increases (L-shape) were seen in Continental Europe (Germany, France, Netherlands, Switzerland) and in Japan.

**3.2 RISE IN GLOBAL HOUSEHOLD INDEBTEDNESS** [Figure 2](#) displays data from national statistics, starting in 1990, on household net lending as a percentage of GDP. It examines the same three sets of countries identified above. Prior to the onset of the Great Recession, households in U-shaped countries increasingly became net borrowers, while households in L-shaped countries slightly increased their net lending, with the exception of the Netherlands. The trend for L/U

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<sup>8</sup>This database is available at <http://g-mond.parisschoolofeconomics.eu/topincomes/>. It covers Argentina, Australia, Canada, China, Finland, France, Germany, India, Indonesia, Ireland, Italy, Japan, Netherlands, New Zealand, Norway, Portugal, Singapore, Spain, Sweden, Switzerland, the United Kingdom and the United States.

shaped countries is intermediate. They were net lenders until 2002, but half of them became net borrowers by 2007, over the same period during which their income inequality increased the most. In order to complement these flow measures, [figure 3](#) shows data for the stock of household loans relative to GDP.<sup>9</sup> We observe a large and persistent increase in the ratio of household loans to GDP for the U-shaped countries. The L-shaped countries exhibit a stable pattern, with the exception of the Netherlands and, starting from a very low level, France. L/U-shaped countries also exhibit an increasing pattern, but mostly starting from a much lower level than U-shaped countries.

However, our theory stresses increases in borrowing among low and middle income households rather than aggregate borrowing or saving rates. This requires a more detailed look at data where much less uniform cross-country coverage is available. While a series of very useful papers on the evolution of income, consumption, and wealth inequality has been published under the Cross Sectional Facts for Macroeconomists project by the Review of Economic Dynamics, data on the evolution of leverage across the income distribution do not exist for all countries. Where they are available, the evidence for U-shaped countries suggests that the rise in aggregate leverage has mostly been due to higher leverage of low and middle income households.

For the United States, Slesnick (2000), Heathcote et al. (2010), and Krueger and Perri (2006) stress that the rise in income inequality has been much more pronounced than the increase in consumption inequality, which implies increased borrowing by lower-income households.<sup>10</sup> Kopczuk et al. (2010) show that the increase in income inequality was not accompanied by an increase in income mobility, and that it was lifetime rather than transitory income shocks that were the driving force behind rising income inequality. Kumhof and Ranci ere (2010) show that the rise in aggregate household leverage has been exclusively due to an increase in leverage of the bottom 95% of the income distribution.

Starting in the late 1980s, the United Kingdom experienced similar diverging trends between income and consumption inequality, which are documented in Blundell and Preston (1998) and Blundell and Etheridge (2010). They also find similar results to Kopczuk et al. (2010) concerning transitory versus lifetime income shocks. Data on saving rates across the income distribution are documented by Crossley and O’Dea (2010), who show that from 1975 to 2007 the median saving rate of the top quintile of the income distribution increased while that of the bottom quintile decreased. Lebarz (2011) shows that households in the bottom 50% of the income distribution experienced an increase in their debt-to-income ratio from 95% to 150% between 2000 and 2005, while for the top 5% this ratio only increased from 70% to 80%.

For Canada, Brzozowski et al. (2010) find that income inequality has increased substantially over the last 30 years. Similar to the United States and the United Kingdom, this has been accompanied by a much smaller rise in consumption inequality, and by similar results to Kopczuk et al. (2010) concerning transitory versus lifetime income shocks. As shown in Lebarz (2011), the debt-to-income ratio of households in the bottom 95% of the income distribution almost doubled between 1984 and 2000, from 50% to 99%, while for the top 5% this ratio only increased from 40% to 50%.

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<sup>9</sup>The sources for the data in [figures 2](#) and [3](#) are detailed in [table 2](#).

<sup>10</sup>This has since been the subject of an ongoing debate. On the one hand, Aguiar and Bils (2012) argue that, once systematic measurement errors are corrected, the evolution of consumption inequality closely tracks that of income inequality. On the other hand, Meyer and Sullivan (2010) propose an alternative way of correcting for measurement errors and for other issues involved in constructing the data. They conclude that the increase in consumption inequality has been less pronounced than the increase in income inequality, particularly for the most recent decade.

For Australia and New Zealand, Lebarz (2011) documents similar facts as for the United States, the United Kingdom and Canada, with household leverage concentrated among households in the bottom income group, in the 2000s, in both countries.

The Italian, Swedish and Spanish cases, which are discussed in Jappelli and Pistaferri (2010), Domeij and Floden (2010), and Pijoan-Mas and Sanchez-Marcos (2010), are different from the above countries in that they did not display a clear increase in leverage that was limited to lower and middle income groups. For the case of the Germany (an L-shaped country), the evolution of income inequality, consumption inequality, and wealth inequality has been documented by Fuchs-Schündeln et al. (2010). They find that inequality was relatively stable in West Germany until German reunification, and then trended upwards for wages and market incomes. However, disposable incomes and consumption display only a modest increase in inequality over the same period,<sup>11</sup> and household debt-to-income ratios did not show a pronounced increase.

**3.3 RISE IN GLOBAL CURRENT ACCOUNT IMBALANCES** Figure 4, which uses data from the IMF's World Economic Outlook database, shows the evolution of global current account balances starting in 1980. Many of the current account deficit countries are in the same group that exhibited, nearly simultaneously, a large increase in income inequality, including the United States, the United Kingdom, Italy, Ireland and Portugal. Conversely, countries that exhibited stable top income shares, including Germany, Japan, Switzerland and France, also experienced balanced current accounts or surpluses. Our proposed explanation for this phenomenon is that many deficit countries finance a part of growing domestic household indebtedness through foreign savings provided by surplus countries, thereby causing an increase in global current account imbalances.

As figure 5 illustrates, from approximately 1980 to 2000 (data coverage varies by country) there is a very strong negative cross-country correlation, of almost  $-0.8$ , between changes in top 5% income shares and changes in current-account-to-GDP ratios among OECD countries. That is, an increase of one percentage point of the top 5% income share over the period corresponds to a deterioration of the current-account-to-GDP ratio of 0.8 percentage points. The sign, but not the magnitude, of this relationship will survive the introduction of numerous control variables in our econometric analysis. The correlation vanishes when emerging economies are included. A strength of our theoretical model is that it offers an explanation for both facts, where the key difference between OECD countries and developing countries is the state of development of domestic financial markets.

**3.4 ECONOMETRIC ANALYSIS** Figure 5 provides evidence of a strongly negative cross-country correlation between changes in top 5% income shares and changes in current accounts over the two decades from 1980 to 2000. In other words, countries that have experienced an increase in income inequality have tended to see their current account balances deteriorate. However, there are a number of other candidate explanations for current account deteriorations, some of which are likely correlated with changes in the income distribution. To account for this issue, we perform a multivariate analysis of current account determinants using an unbalanced panel of 18 OECD countries over the period 1968-2006.<sup>12</sup> We test whether top income shares and proxies for domestic financial liberalization have additional explanatory power when they are added to a benchmark

<sup>11</sup>Bach et al. (2011) find an increase in German top income shares starting in the late 1990s. However, they use different sources from the World Top Incomes database, whose last available German data point is 1998.

<sup>12</sup>The sample of countries is constrained by the availability of data on top income shares (see footnote 8)



set of explanatory variables that comes from the panel estimation literature on current account determinants. Key references in this literature include Chinn and Prasad (2003), Gruber and Kamin (2005), Chinn and Ito (2008, 2009), and Chinn et al. (2011).

**3.4.1 ECONOMETRIC METHODOLOGY** We follow the “autoregressive distributed lag (ARDL) approach” to long-run modeling developed by Pesaran and Smith (1995), Pesaran (1997), and Pesaran and Shin (1998). We employ this specification because our goal is to test whether top income shares have additional explanatory power for both the short-run and the long-run dynamics of the current account. ARDL exploits the fact that the sample we use for estimation is a “data field”, in the sense that it is characterized by time-series and cross-section dimensions of similar magnitude. The objective is to jointly estimate both a long-run relationship and short-run adjustment dynamics between the current account and its determinants. We present two alternative ARDL estimations, a dynamic fixed effects specification and a pooled mean group specification.

For the dynamic fixed effects specification, the estimated ARDL(p,q) model can be written in error-correction form as

$$CA_{i,t} - CA_{i,t-1} = \sum_{j=1}^{p-1} \gamma_j \Delta CA_{i,t-j} + \sum_{j=0}^{q-1} \delta_j \Delta X_{i,t-j} + \phi [CA_{i,t-1} - \eta_i - \beta X_{i,t-1}] + \varepsilon_{i,t}, \quad (1)$$

where  $\gamma_j$  and  $\delta_j$  are the short-run coefficients on lagged changes in the current account  $CA_{i,t}$  and in the covariates  $X_{i,t}$ ,  $\beta$  is the vector of long-run coefficients on the covariates, and  $\phi$  is the speed of adjustment to the long-run relationship. The error terms  $\varepsilon_{i,t}$  are independently distributed across  $i$  and  $t$ , with zero means and variances  $\sigma_i^2 > 0$ . The term in square brackets contains the long-run relationship, which acts as a forcing equilibrium condition. The dynamic fixed effects estimator restricts cross-country heterogeneity to the intercept  $\eta_i$ . Under this specification, an ARDL(2,1) is statistically preferred.

For the pooled mean group specification, the estimated ARDL(p,q) model can be written as

$$CA_{i,t} - CA_{i,t-1} = \sum_{j=1}^{p-1} \gamma_{ij} \Delta CA_{i,t-j} + \sum_{j=0}^{q-1} \delta_{ij} \Delta X_{i,t-j} + \phi_i [CA_{i,t-1} - \eta_i - \beta X_{i,t-1}] + \varepsilon_{i,t}. \quad (2)$$

This specification allows the parameters controlling short-run dynamics and the convergence to the long-run equilibrium to be heterogeneous across countries. This significantly reduces the available degrees of freedom, and therefore the precision of the estimates, for two reasons. First, it increases the number of estimated parameters. Second, the sample itself is smaller, since this estimator, to obtain country-specific estimates of short-run coefficients, requires that all variables included in the short-run specification be non-missing for every country in the sample. This requirement reduces the number of countries included in the sample from 14 to 10, and the number of observations from around 400 to 239. Given these drawbacks, we present the pooled mean group estimation results as a robustness check. We note that under this specification an ARDL(1,1) is statistically preferred to an ARDL(2,1).

The consistency and efficiency of the dynamic fixed effects and pooled mean group estimates relies on three specification conditions. First, the coefficient on the error-correction term must be negative and less than one in absolute value. This condition, which ensures stationarity of current account dynamics and convergence towards the long-run equilibrium relationship, is satisfied by all of our estimated regressions. Second, the shocks in the dynamic specification must

be serially uncorrelated. This condition is met by including two lags for the dependent variable in the short-run specification. Third, regression residuals must be independent across countries. In practice, non-zero error covariances usually arise from omitted common factors that influence multiple countries' ARDL processes. As is standard in the empirical literature on current accounts, we address this problem by transforming all variables of a given year into deviations from their cross-sectional means for that year.<sup>13</sup>

We use annual data. Long-run controls include youth and old dependency ratios and the trade-to-GDP ratio. Short-run controls include relative income, average real GDP growth, the trade-to-GDP ratio and the net foreign assets-to-GDP ratio. Table 1 provides a description of the variables.

We add to this list the top 5% income share, using the dataset of Atkinson et al. (2011), and a proxy for domestic financial liberalization. Although the private credit-to-GDP ratio is typically used in the empirical literature as a proxy for financial development, we find that private credit from non-bank financial institutions better captures domestic financial liberalization in advanced countries. Thus, we distinguish between private credit from deposit money banks and private credit from non-bank financial institutions (using the classification terminology of the IMF's International Financial Statistics database). In the United States, private credit from non-bank financial institutions increased five-fold between 1980 and 2008 (from 37% to 150% of GDP), while private credit from deposit money banks only increased moderately (from 55% to 65% of GDP).

Finally, we add to the short-run specification a variable that captures shocks to the government balance. But rather than using the cyclically adjusted primary balance, which is commonly used in the literature, we use the cross-country dataset of Leigh et al. (2011), who adopt a "narrative approach". Specifically, they identify discretionary changes in taxes and government spending motivated primarily by the desire to reduce the budget deficit, rather than by a response to the short-term economic outlook or to the current account. Bluedorn and Leigh (2011) have shown that this measure has much larger effects on the current account than the cyclically adjusted primary balance. Importantly, regressions that add this variable to the set of regressors need to exclude mediating explanatory variables that could capture indirect effects of government balances on current account balances. This includes measures of economic activity, trade and debt.

**3.4.2 RESULTS** Table 3 presents the results of the dynamic fixed effects ARDL estimation of long-run and short-run parameters linking the current account balance to its determinants. We consider three alternative sets of specifications, using either the top 5% income share or the top 1% income share as the measure of income inequality. Regressions 1 and 2, the most parsimonious specifications, include only top income shares and private credit-to-GDP ratios as regressors. Regressions 3 and 4 follow Leigh et al. (2011) and Bluedorn and Leigh (2011), by augmenting Regressions 1 and 2 with the government balance, but otherwise only adding a basic set of controls, namely the dependency ratios and trade openness, in the long run relationship. Finally, Regressions 5 and 6 add a full set of controls taken from the empirical literature on the determinants of current accounts.

For measures of inequality, we find that the current account balance is negatively and significantly linked to the top 5% and top 1% income shares in the long run. The estimates are remarkably stable across the three specifications. They imply that a one percentage point increase in the top 5%

<sup>13</sup>Cross-sectional demeaning is performed using GDP weights, which is standard in the literature. Demeaned variables are constructed for country  $j$  as  $\tilde{X}_{j,t} = X_{j,t} - \sum_{i=1}^J (GDP_{i,t} X_{i,t}) / \sum_{i=1}^J GDP_{i,t}$ , where  $i$  indexes each country in the sample of  $J$  countries.

income share leads to a longer-run deterioration of the current account ranging from 0.16 to 0.19 percentage points. A one percentage point increase in the top 1% income share leads to a longer-run deterioration of the current account ranging from 0.33 to 0.4 percentage points. Between the late 1970s and 2006, the United Kingdom experienced an increase in the top 5% income share of around 10 percentage points. Similar magnitudes were observed in the United States. Our estimate for the top 5% income share suggests a current account deterioration of around 1.6 to 1.9 percent of GDP in the longer run. This is roughly equal to the actual current account deterioration experienced by the United Kingdom over this period, which suggests that this channel is economically significant.

For measures of domestic financial liberalization, we find that the current account is negatively related to the private credit-to-GDP ratios. Private credit from non-bank financial institutions, our preferred proxy for domestic financial liberalization, has a negative long-run impact on current account balances that is stronger than the effect of private credit from banks and consistently significant across all specifications. For any given country, our estimates in [table 3](#) imply that a one percentage point increase in the cross-sectional deviation of this ratio<sup>14</sup> corresponds to roughly a 0.05 percentage point deterioration in the current-account-to-GDP ratio. For instance, between 1980 and 2008 the ratio of private credit from non-bank financial institutions to GDP experienced a much larger increase in the United States than the mean increase in the other countries of the panel. The cross-sectional deviation is 70 percentage points, which explains a deterioration of around  $70 \times 0.05 = 3.5$  percentage points of the current account-to-GDP ratio.

We emphasize that it is difficult to disentangle the separate effects of income inequality and of domestic financial liberalization, for two reasons. First, financial liberalization may be an endogenous response to an increase in inequality, as Rajan (2010) claims for the United States. Second, greater inequality may be an endogenous consequence of financial liberalization, as suggested by Philippon (2008) and Philippon and Reshef (2009).

The Leigh et al. (2011) measure of the government balance is significant in Regression 3. Specifically, a one percentage point increase in the government balance-to-GDP ratio is associated with a 0.23 percentage point increase in the current account-to-GDP ratio. This is significantly smaller than the approximately 0.6 percentage points found by Bluedorn and Leigh (2011). However, as we will discuss, our pooled mean group regression yields very similar results to Bluedorn and Leigh (2011). Furthermore, unlike for these authors, Regressions 3 and 4 include potential mediating variables, namely the top income shares. This could be significant because, as discussed in Bastagli et al. (2012), fiscal policies around the world have had significant effects on income inequality.

For the conventional explanatory variables in Regressions 5 and 6 we replicate findings that are common in this literature. Specifically, we find that in the long run the current account is negatively related to the old dependency ratio, and positively related to the youth dependency ratio and the trade-to-GDP ratio. Among the short-run explanatory variables, relative incomes have a highly significant negative effect on current accounts, while net foreign asset positions have a positive effect.

[Table 4](#) presents the results of the pooled mean group ARDL estimation. The effects of top income shares are of a similar magnitude to the dynamic fixed effects regressions. The private

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<sup>14</sup>Recall that we perform cross-sectional demeaning for all explanatory variables. In our sample the demeaned data for private credit from non-bank financial institutions vary between -60 and +80 percentage points.

credit-to-GDP variables also have a mostly significant, albeit somewhat smaller, effect. The trade-to-GDP ratio has a stronger long-run positive effect, while dependency ratios are mostly not statistically significant for this specification. The short-run coefficients for relative income and net foreign assets are very similar to [table 3](#). In Regressions 3 and 4 shocks to the government balance are now not only statistically significant but also of a very similar size to the results in [Bluedorn and Leigh \(2011\)](#).

## 4 ECONOMIC MODEL

We build our economic model to help us understand the econometric results. Similar to the econometric analysis, we introduce separate shocks for income inequality and for domestic financial liberalization, even though the former may to a significant extent be caused by the latter and vice versa.

The world economy consists of two countries, Home and Foreign, with Home's share of the world population given by  $\omega$ . The Foreign economy features households and firms, while the Home economy consists of investors, who own the economy's capital stock and are net lenders in domestic financial markets, workers, who earn income exclusively through labor earnings and are net borrowers in domestic financial markets, and firms, who combine capital and labor to produce aggregate output. Agents within each group are identical.

**4.1 HOME INVESTORS** Investors maximize their lifetime utility function, given by

$$E_0 \sum_{t=0}^{\infty} \beta_i^t \left\{ \frac{(c_t^i)^{1-\frac{1}{\sigma_i}}}{1-\frac{1}{\sigma_i}} + \xi_d \log \left( d_t + \frac{\xi_f}{\xi_d} e_t f_t \right) + \xi_k \log(\psi_k + k_t) \right\}, \quad (3)$$

where  $c_t^i$  is investors' consumption,  $\sigma_i$  is the intertemporal elasticity of substitution in investors' consumption,  $d_t$ ,  $f_t$  and  $k_t$  are domestic bank deposits, foreign bonds and physical capital held between periods  $t$  and  $t+1$ ,  $\xi_d$ ,  $\xi_f$  and  $\xi_k$  are the corresponding preference weights,  $\psi_k$  determines the sensitivity of investment in physical capital to increases in investors' income, and  $e_t$  is the real exchange rate, expressed in units of domestic consumption per unit of foreign consumption. Real and financial assets are imperfect substitutes in investors' preferences. Domestic and foreign financial assets are also imperfect substitutes, as utility differentials compensate investors for a steady state positive return differential between foreign bonds and domestic deposits, in a similar fashion to money-in-the-utility-function specifications. The monetary function of domestic financial assets has recently been stressed by [Gorton et al. \(2012\)](#), and it plays an important role in our results for the current account.

Investors' budget constraint is given by

$$e_t f_t q_t^* + d_t q_t^d = e_t f_{t-1} + d_{t-1} + r_{k,t} k_{t-1} - p_t^{ci} c_t^i - p_t^{inv} I_t + \Pi_t^b, \quad (4)$$

where  $q_t^d$  is the time  $t$  price of one unit of domestic bank deposits that matures in period  $t+1$ , and  $q_t^*$  is the time  $t$  price of foreign bonds, in units of the foreign good. The rental rate of capital is denoted by  $r_{k,t}$  and  $I_t$  is investment. Investor consumption and investment goods,  $c_t^i$  and  $I_t$ , are produced using Cobb-Douglas technologies in domestic and foreign output, with home bias share coefficients  $\gamma_c$  and  $\gamma_I$ . All relative prices have the price of domestic output as numeraire, with  $p_t^{ci}$  and  $p_t^{inv}$  representing the relative prices of investor consumption goods and investment

goods. Investors are the owners of a monopolistically competitive banking sector and receive the profits of that sector  $\Pi_t^b$  as a lump-sum payment each period. Capital accumulation is given by  $k_t = (1 - \delta)k_{t-1} + I_t$ , where  $\delta$  is the physical depreciation rate. Let  $\lambda_t^i$  be the multiplier of (4). Then we obtain the following first-order optimality conditions for domestic deposits, foreign bonds and physical capital,

$$1 = \beta_i E_t \left( \frac{\lambda_{t+1}^i}{\lambda_t^i q_t^d} \right) + \frac{\xi_d}{\left( d_t + \frac{\xi_f}{\xi_d} e_t f_t \right) \lambda_t^i q_t^d}, \quad (5)$$

$$1 = \beta_i E_t \left( \frac{\lambda_{t+1}^i \frac{e_{t+1}}{e_t}}{\lambda_t^i q_t^*} \right) + \frac{\xi_f}{\left( d_t + \frac{\xi_f}{\xi_d} e_t f_t \right) \lambda_t^i q_t^*}, \quad (6)$$

$$1 = \beta_i E_t \left( \frac{\lambda_{t+1}^i (r_{t+1}^k + p_{t+1}^{inv} (1 - \delta))}{\lambda_t^i p_t^{inv}} \right) + \frac{\xi_k}{(\psi_k + k_t) \lambda_t^i p_t^{inv}}, \quad (7)$$

where  $\lambda_t^i = 1/(p_t^{ci} (c_t^i)^{1/\sigma_i})$ . These conditions show the different ways in which investors can respond to additional income gained through redistributive shocks. Namely, they can increase their consumption, their investment in physical capital, and their investment in financial assets. An increase in financial assets can take the form of larger holdings of domestic financial assets at unchanged holdings of net foreign assets, or of higher/lower foreign borrowing to finance even larger/smaller increases in domestic financial assets. Investors act as financial intermediaries for foreign funds, because workers do not have direct access to foreign financial markets.

**4.2 HOME WORKERS** Workers maximize their lifetime utility function, given by

$$E_0 \sum_{t=0}^{\infty} \beta_w^t \left\{ \frac{(c_t^w)^{1 - \frac{1}{\sigma_w}}}{1 - \frac{1}{\sigma_w}} \right\}, \quad (8)$$

where  $c_t^w$  is workers' consumption and  $\sigma_w$  is the intertemporal elasticity of substitution in workers' consumption. Workers inelastically supply one unit of labor per period. Their budget constraint is given by

$$\ell_t q_t = \ell_{t-1} + p_t^{cw} c_t^w - w_t, \quad (9)$$

where  $q_t$  is the time  $t$  price of one unit of domestic bank loans,  $\ell_t$ , that matures in period  $t + 1$ ,  $w_t$  is the real wage, and  $p_t^{cw}$  is the relative price of worker consumption goods. The latter are produced using a Cobb-Douglas technology in domestic and foreign output, with the same home bias share coefficient,  $\gamma_c$ , as in investors' consumption goods technology.

Let  $\lambda_t^w$  be the multiplier of (9). Then we obtain the following first-order optimality condition for bank loans

$$1 = \beta_w E_t \left( \frac{\lambda_{t+1}^w}{\lambda_t^w q_t} \right),$$

where  $\lambda_t^w = 1/(p_t^{cw} (c_t^w)^{1/\sigma_w})$ . Workers respond to income lost through redistributive shocks by either reducing consumption or increasing borrowing.

**4.3 HOME BANKS** Domestic financial liberalization is introduced in the simplest possible fashion, by allowing for shocks that reduce the intermediation spread of an imperfectly competitive banking sector. In our model this spread measures the difference between lending and borrowing rates. But the reduction of this spread can be thought of more broadly as representing a range of phenomena during financial liberalizations, including a reduction in service charges and in the non-interest cost of obtaining access to loans.

There is a continuum of banks, with each bank  $z \in [0, 1]$  offering a loan variety  $\ell_t(z)$ . Each bank is competitive in the deposit market and attracts homogenous deposits from investors at the gross interest rate  $1/q_t^d$ . Banks are monopolistically competitive in the loan market, where each bank makes loans at gross interest rate  $1/q_t(z)$ , and where borrowers demand a Dixit-Stiglitz aggregate of loan varieties denoted by  $\ell_t$ , with elasticity of substitution  $\theta_t$ . Banks maximize profits, given by

$$(1/q_t(z))\ell_t(z) - (1/q_t^d)\ell_t(z), \quad (10)$$

by choosing their loan interest rate subject to a Dixit-Stiglitz demand function for their loan variety. This yields the optimality condition

$$1/q_t = (1/q_t^d)s_t, \quad (11)$$

where  $q_t$  is the aggregate price index for loans, and where the spread is given by  $s_t = (\theta_t + 1)/\theta_t$ . Banks' profits are given by  $\Pi_t^b = d_t(q_t^d - q_t)$ . We assume that the spread follows an autoregressive stochastic process that is given by  $s_t = (1 - \rho_s)\bar{s} + \rho_s s_{t-1} + \varepsilon_t^s$ , where  $\varepsilon_t^s \sim i.i.d.N(0, \sigma_s^2)$ .

**4.4 HOME FIRMS** Firms are owned by investors and operate the economy's production technology

$$y_t = A(\chi k_{t-1})^\alpha (h_t)^{1-\alpha}, \quad (12)$$

where  $A$  is a scale factor that normalizes the economy's calibrated steady state output level,  $\alpha$  is the capital share, and  $h_t$  is hours worked. We assume that the number of firms equals the number of workers and that all firms and workers are identical. Factor returns are determined by the outcome of a decentralized and segmented Nash bargaining problem over the real wage, where firms negotiate on behalf of their owners, investors. Specifically, at the beginning of each period each firm is matched with exactly one worker to bargain over the real wage. If bargaining fails, no output is produced, no wage is paid, and agents must wait one period before being able to bargain again. Workers' outside option is assumed to be zero. Denoting workers' bargaining power by  $\eta_t$ , we have

$$\max_{w_t} (W_{h_t})^{\eta_t} (K_{h_t})^{1-\eta_t}, \quad (13)$$

where  $W_{h_t} = \lambda_t^w w_t$  is workers' surplus, and  $K_{h_t} = f_{h_t} - w_t$  is investors' surplus. The marginal product of labor,  $f_{h_t}$ , is given by  $f_{h_t} = (1 - \alpha)y_t/h_t$ . The first-order condition of the bargaining problem is given by

$$w_t = \eta_t f_{h_t}. \quad (14)$$

This sets the real wage equal to workers' bargaining power multiplied by the marginal product of labor, and it implies that  $\eta_t \in [0, \frac{1-\chi}{1-\alpha}]$ . The standard competitive (and efficient) outcome obtains at a bargaining power of one. The rental rate of capital is determined residually as  $r_{k,t} = (y_t - w_t h_t)/(\chi k_{t-1})$ . We assume that workers' bargaining power follows an autoregressive stochastic process given by  $\eta_t = (1 - \rho)\bar{\eta} + \rho\eta_{t-1} + \varepsilon_t^\eta$ , where  $\varepsilon_t^\eta \sim i.i.d.N(0, \sigma_\eta^2)$ .

**4.5 FOREIGN AGENTS** The foreign representative household is both an investor and a worker and maximizes lifetime utility, given by

$$E_0 \sum_{t=0}^{\infty} \beta_*^t \left\{ \frac{(c_t^*)^{1-\frac{1}{\sigma_*}}}{1-\frac{1}{\sigma_*}} + \xi_{f^*} \log(\psi_{f^*} + f_t^*) + \xi_{k^*} \log(\psi_{k^*} + k_t^*) \right\}, \quad (15)$$

where  $c_t^*$  is Foreign consumption,  $\sigma_*$  is the intertemporal elasticity of substitution in Foreign agents' consumption,  $f_t^*$  and  $k_t^*$  are bonds and physical capital held between periods  $t$  and  $t+1$ ,  $\xi_{f^*}$  and  $\xi_{k^*}$  are the corresponding preference weights, and  $\psi_{k^*}$  determines the sensitivity of investment in physical capital to increases in Foreign agents' income. We calibrate the coefficient  $\psi_{f^*}$  so that the largest stable root in the linearized model is very close to one. This extends the work of Schmitt-Grohe and Uribe (2003) to an environment with wealth in the utility function, and it implies that net foreign assets take a very long time to return to their steady state value following a shock.

Foreign households' budget constraint is given by

$$f_t^* q_t^* = f_{t-1}^* + r_{k,t}^* k_{t-1}^* + w_t^* - p_t^{c^*} c_t^* - p_t^{inv^*} I_t^*, \quad (16)$$

where we have assumed, as for Home workers, that Foreign households inelastically supply one unit of labor. Capital accumulation is given by  $k_t^* = (1 - \delta^*) k_{t-1}^* + I_t^*$ . Let  $\lambda_t^*$  be the multiplier of (16). Then  $\lambda_t^* = 1/(p_t^{c^*} (c_t^*)^{(1/\sigma_*)})$ , and the first-order optimality conditions for foreign bonds and physical capital are

$$1 = \beta_* E_t \left( \frac{\lambda_{t+1}^*}{\lambda_t^* q_t^*} \right) + \frac{\xi_{f^*}}{(\psi_{f^*} + f_t^*) \lambda_t^* q_t^*}, \quad (17)$$

$$1 = \beta_* E_t \left( \frac{\lambda_{t+1}^* (r_{k,t+1}^* + p_{t+1}^{inv^*} (1 - \delta^*))}{\lambda_t^* p_t^{inv^*}} \right) + \frac{\xi_{k^*}}{(\psi_{k^*} + k_t^*) \lambda_t^* p_t^{inv^*}}. \quad (18)$$

The Foreign production technology is given by

$$y_t^* = A^* (k_{t-1}^*)^{\alpha^*} (h_t^*)^{1-\alpha^*}, \quad (19)$$

where  $y_t^*$  is Foreign output,  $A^*$  is a scale factor that normalizes Foreign's steady state output level,  $k_t^*$  is Foreign capital and  $h_t^*$  is Foreign hours worked. Foreign factor prices are determined in competitive factor markets. Thus,  $w_t^* h_t^* = (1 - \alpha^*) y_t^*$  and  $r_{k,t}^* k_{t-1}^* = \alpha^* y_t^*$ . Foreign consumption and investment goods,  $c_t^*$  and  $I_t^*$ , are produced using Cobb-Douglas technologies in domestic and foreign output.

**4.6 EQUILIBRIUM** In equilibrium all households maximize their respective lifetime utilities, and goods, labor and financial markets clear. Denoting the home and foreign goods components in the five Cobb-Douglas technologies for  $c_t^i$ ,  $c_t^w$ ,  $I_t$ ,  $c_t^*$  and  $I_t^*$  by adding a  $h$  and  $f$  to the respective superscripts, we have the Home and Foreign goods market clearing conditions

$$\omega y_t = \omega \chi (c_t^{ih} + I_t^h) + \omega (1 - \chi) c_t^{wh} + (1 - \omega) (c_t^{h^*} + I_t^{h^*}), \quad (20)$$

$$(1 - \omega) y_t^* = (1 - \omega) (c_t^{f^*} + I_t^{f^*}) + \omega \chi (c_t^{if} + I_t^f) + \omega (1 - \chi) c_t^{wf}. \quad (21)$$

For Home and Foreign labor, the inelastic labor supply assumptions imply  $h_t = 1 - \chi$  and  $h_t^* = 1$ . The market clearing conditions for domestic and international financial markets are given by

$$(1 - \chi)\ell_t = \chi d_t, \quad (22)$$

$$\omega \chi f_t + (1 - \omega) f_t^* = 0. \quad (23)$$

To close the model, the current account equation, written from Home's perspective, is given by

$$\chi e_t f_t q_t^* = \chi e_t f_{t-1} + \frac{1 - \omega}{\omega} (c_t^{h^*} + I_t^{h^*}) - e_t (\chi (c_t^{if} + I_t^f) + (1 - \chi) c_t^{wf}). \quad (24)$$

## 5 SIMULATION RESULTS

This section discusses the model's calibration, the computational methodology, and simulation results.

**5.1 CALIBRATION** The steady state of the model is calibrated to U.K. data. We choose the United Kingdom for two reasons. First, it is among the countries that have experienced the largest increases in income inequality since the late 1970s. Second, its share in world GDP is representative of several other deficit countries.

Since we are interested in the period from the late 1970s until just before the 2007 financial crisis, we use data averages from 1979-2007, depending on availability, to calibrate the model. We calibrate the initial steady state workers' debt-to-income ratio and net-foreign-liabilities-to-GDP ratio to their 1980 values (1979 values were not available), given that our interest is in the subsequent evolution of these variables.

The relative country size,  $\omega$ , is calibrated so that Home accounts for 4.5% of world GDP, which equals both the 1979 value and the 1979-2007 sample average for the United Kingdom. We set the domestic population size of investors,  $\chi$ , to 0.05.

In the utility functions, the intertemporal elasticity of substitution equals 0.5 for all agents. The Home coefficient on domestic financial investments,  $\xi_d$ , is set to obtain an initial workers' debt-to-income ratio of 60 percent, equal to the U.K. value for 1980 according to DeBelle (2004). The Home coefficient on foreign bond holdings,  $\xi_f$ , is set to obtain an initial net foreign liabilities-to-GDP ratio of 8 percent, also equal to the U.K. value in 1980. The calibration of  $\psi_{f^*}$  implies that the elasticity of international interest rates with respect to net foreign liabilities is positive but very small.

The remaining coefficients of agents' utility functions imply a steady state gross real interest rate on domestic loans of 1.05, and a steady state gross return to capital after depreciation equal to 1.05. The steady state gross rate on foreign loans, which corresponds to LIBOR in the data, equals 1.04, while the steady state gross deposit rate equals 1.02. This implies a steady state banking spread,  $s$ , equal to 3 percent. These spreads are consistent with the very detailed information on spreads in U.S. banking reported by Ashcraft and Steindel (2008) for 2006. These authors find an approximate spread of domestic loan rates over the rate on U.S. treasury bills equal to 1.5 percentage points, and an approximate spread of domestic bank cost of funds under the rate on U.S. treasury bills equal to 1.5 percentage points. The spread of LIBOR over the rate on U.S. treasury bills is typically around 0.5 percentage points.

We set the coefficients  $\psi_k$  and  $\psi_k^*$  to ensure that the elasticity of physical investment with respect to income shocks is significantly lower than the elasticity of financial investment. Since investors



own the entire capital stock, their per capita capital stock is very large relative to per capita loans. If the log of the sum of capital and loans were to enter the utility function, this would imply that the elasticity of these two forms of wealth with respect to income shocks would be very similar. This would imply a very large, and unrealistic, level for the elasticity of physical investment. Introducing the two forms of wealth separably, and calibrating  $\psi_k$  and  $\psi_k^*$  appropriately, avoids that implication. It also allows us to obtain a unique steady state value for the stocks of loans and deposits.

The factor share coefficient of the production function,  $\alpha$ , is calibrated to obtain an investment-to-GDP ratio of 17.5 percent, which is approximately equal to both the U.K. value in the early 1980s and the sample average for 1979-2007. The depreciation rate equals 10 percent per annum. The Cobb-Douglas share coefficients of the trade technologies are calibrated to produce consumption goods imports-to-GDP ratios of 6 percent and investment goods imports-to-GDP ratios of 7.2 percent, based on 1979-2007 sample averages.

Finally, we calibrate the persistence of the two shock processes to  $\rho_\eta = \rho_s = 0.995$ . This is based on the observation that changes in realized top income shares and in U.K. financial system regulation have been close to permanent, and we assume that this was fully expected by households. Calibration of the two shock processes as unit roots is infeasible for computational reasons.

**5.2 COMPUTATIONAL METHODOLOGY** Our model is designed to match the persistent growth in income inequality, household debt and foreign debt observed over past decades. Because this implies highly persistent and very large deviations of state variables from their initial steady state values, a local solution method is inadequate to accurately capture the long-run dynamics. Thus, we obtain a global nonlinear solution using a time-iterative policy function algorithm. This exploits the theory of monotone operators, which have useful theoretical and numerical properties. For example, a monotone operator is used to prove existence and uniqueness of equilibrium of non-optimal economies by Coleman (1991). This solution technique discretizes the state space and iteratively solves for updated policy functions that satisfy equilibrium conditions until a specified tolerance criterion is reached. For additional information and examples of how the algorithm is applied to conventional real business cycle and new Keynesian models see Richter et al. (2012).

**5.3 INCREASED INEQUALITY** Figure 6 simulates a cumulative 10 percent decline in workers' bargaining power over a period of 18 years. Towards the end of the third decade following the initial shock, which corresponds to the 1979-2007 period for which we have U.K. data, this leads to a real wage drop, relative to trend, of around 7 percent and an increase in the return to capital of around 2 percentage points. The bottom right panel shows that this income redistribution closely matches the change in the top 5% income share in U.K. data for the period 1979-2007.

The third row shows workers' responses to their income losses. Higher loans from investors increase workers' leverage, or debt-to-income ratio, from 60 percent to 140 percent after 30 years. This increase, while very large, is still less than what was observed in the data. In the short run, higher debt allows workers to reduce their consumption by less than the drop in their wage, but in the longer run workers' consumption continues to fall even when their real wage starts to recover (this recovery is due to a slow recovery in bargaining power combined with a rising capital stock). The reason is that by this time debt service consumes a far larger and growing portion of workers' disposable income, around 7 percent compared to 3 percent in the original steady state.

The second row shows that investors respond to their income gains by increasing consump-

tion (by 50 percent after three decades), by increasing physical investment (by 12 percent after 3 decades), and by using their domestic income gains to increase loans to workers (by 90 percent after 3 decades, with significant further growth thereafter).<sup>15</sup> However, in an open economy there is a fourth possibility—even larger loans to workers financed by borrowing from foreign investors. Or, to put it differently, in an open economy workers can obtain loans not only from domestic investors, but also loans from foreign investors that are intermediated by domestic investors. This effect is shown in the fourth row, which shows a decline in net foreign assets that reaches over 4 percent of GDP by the end of the third decade, accompanied by a deterioration in the current account that reaches just over 0.2 percent of GDP around year 20, with the current account gradually closing thereafter. However, without accounting for financial liberalization this effect is significantly smaller than the current account deterioration experienced by the United Kingdom since the late 1970s.<sup>16</sup>

The current account deteriorates because of the implications of investors’ asset preferences for the capital account. Investors exhibit home bias in financial assets, due to the monetary/liquidity characteristics of domestic currency assets that have recently been stressed by Gorton et al. (2012). In our model this home bias is evident in much larger holdings of domestic relative to foreign currency assets despite a significantly lower return on domestic currency assets. The consequence of home bias is that the increase in lending to workers involves an increase in domestic currency loans that is financed in part by borrowing more from abroad. This implies a capital account surplus and thus a current account deficit, albeit of fairly small size. In [section 5.4](#) we show that domestic financial liberalization greatly amplifies this effect, and in [section 5.5](#) we show that in the complete absence of domestic financial markets current account surpluses emerge rather than current account deficits.

**5.4 INCREASED INEQUALITY ACCOMPANIED BY FINANCIAL LIBERALIZATION** [Figure 7](#) first reproduces the simulation of [figure 6](#) as a black solid line, and then adds an alternative scenario, shown as a blue dashed line, where the same loss in bargaining power is accompanied by a reduction in the banking spread by 150 basis points over the first 10 years. The compression in domestic spreads results in a combination of a lower cost of borrowing and a higher return to saving. This is a simplified representation of U.K. domestic financial liberalization during the “Thatcher years”, including a reduction of non-interest costs of accessing the loan market and the market for financial saving.

The main effect of the higher return to saving is to make investors direct a larger share of their additional income to financial rather than real investments. The main effect of lower borrowing costs is that workers borrow more heavily, to the point that their consumption hardly drops during the first decade despite a steep loss in income. Relative to the previous scenario, this further stimulates aggregate demand. At the same time it restrains aggregate supply by slowing down capital accumulation, especially after investors’ bargaining power stops increasing. This results in a larger increase in the rate of return to capital. Workers’ debt-to-income ratio now reaches around 180 percent after 3 decades, which is much closer to matching (in fact, slightly exceeding) actual U.K. values during the period, while still matching the observed top 5% income share. In the long

<sup>15</sup>As mentioned above, calibration of the parameter  $\kappa_k$  in investors’ preferences is critical for determining the relative changes in physical versus financial investments.

<sup>16</sup>Data for the UK current account-to-GDP ratio are presented as 5-year moving averages to dampen the substantial short-run volatility of this variable.

run, this high debt burden further increases debt servicing costs, so that by around year 20 workers' consumption drops below the values observed in the previous scenario.

However, the most dramatic change is observed for the current account, which now deteriorates by around 2 percentage points by year 10 and in the longer run. This is very close to observed U.K. current account behavior during the period. The main reason is that aggregate demand increases much more, and aggregate supply increases much less, than in the previous scenario. Furthermore, higher deposit rates raise the attractiveness of domestic deposits relative to foreign bonds for domestic investors, given that the interest rate on foreign loans does not change significantly because of the small size of Home relative to the rest of the world. This creates an incentive to invest in domestic deposits financed by foreign loans, which fuels the stronger growth in domestic demand.

**5.5 EMERGING MARKETS: THE ROLE OF CREDIT CONSTRAINTS** So far both the empirical and theoretical parts of our paper have focused exclusively on developed economies. We have found that greater income inequality, with or without added domestic financial liberalization, creates pressures for the current account to deteriorate. However, greater inequality has been a more general worldwide phenomenon. It has also been observed in many emerging economies that have been among the major suppliers of funds to deficit countries. In other words, these countries have run current account surpluses rather than deficits, despite worsening inequality.

This raises the question of whether emerging economies' experiences contradict our results. This section shows that, with an appropriate modification of the model that captures an important difference between emerging and advanced economies, the behavior of emerging economies provides further support for our suggested explanation of global current account imbalances, by helping to explain the supply side of global capital flows. The key difference in our specification of an emerging economy is the nature of financial markets. In many of these countries it is much more difficult for the poor and middle class to borrow than in the United States or the United Kingdom, because of what is generally referred to as "financial market imperfections". It is therefore more difficult for the rich to invest their additional income in domestic financial instruments, while access to foreign financial instruments remains available. For illustrative purposes we model "financial market imperfections" in the simplest possible way, by assuming that Home workers are restricted to consuming their wage income, with zero debt, and with foreign financial wealth as the only financial asset entering domestic investors' utility function. For ease of comparison with the previous simulations, all other aspects of the baseline calibration remain exactly as they were for the United Kingdom. In other words, this is a generic emerging economy, rather than being calibrated to a specific country. The shocks are only to bargaining power, since a reduction in spreads cannot occur in the absence of a domestic financial market.

Figure 8 shows the results as a red dash-dotted line, again overlaid on the results of figure 6. Relative to that simulation, workers' consumption drops more steeply, given their inability to borrow. Because this leads to a fall in aggregate demand relative to the results of figure 6, physical investment rises by less than before. Investors therefore increase investment in the only alternative that remains available to them, foreign financial assets. Additional loans to foreigners generate foreign rather than domestic demand, so that the significantly steeper decrease in workers' consumption is no longer offset by the increase in investors' consumption and investment. The current account improves, with a surplus that exceeds 0.7 percent of GDP by year 20, and that gradually closes thereafter. While this is clearly not the entire explanation for the large surpluses of countries like China, it makes a significant contribution to that explanation, and it resolves the perceived

contradiction mentioned above.

## 6 CONCLUSION

This paper makes an empirical case that increases in income inequality, which have been both a consequence and a cause of domestic financial liberalizations in advanced economies, tend to lead to increases in current account deficits.

Our stylized facts and cross-country econometric evidence suggest that the magnitude of the effect is large, to the point that for the United Kingdom higher income inequality can approximately explain the entire current account deterioration experienced between the late 1970s and 2007. Furthermore, a proxy for domestic financial liberalization is also empirically associated with larger external deficits.

We build a DSGE model that helps to explain the transmission mechanism from higher income inequality to higher domestic and foreign indebtedness. The key feature of the model is that the economy consists of two groups of households, a small group of the very rich (investors) and the majority (workers), who compete over income shares in a bargaining game. When workers' income share declines at the expense of investors, investors respond by lending part of the income they gained back to workers. In addition, investors are able to intermedate foreign savings to domestic workers. They do so because of their home bias in favor of liquid domestic currency assets, and especially because of more attractive returns to saving when domestic financial liberalization is implemented in response to higher income inequality. This lending stimulates aggregate demand and increases current account deficits, despite a significant drop in workers' consumption.

If the policy response to greater inequality includes domestic financial liberalization, this helps workers to maintain consumption in the short run, but it comes at the cost of higher household debt, higher debt service and lower consumption in the long run. Furthermore, it leads to much larger current account deficits as investors take advantage of the attractive lending environment by intermediating larger foreign savings. This has the effect of not only further stimulating aggregate demand, but also of holding back aggregate supply as investors prefer financial over real investments.

Finally, the model can be used to understand the supply side of global current account imbalances, the export of funds and current account surpluses of many important emerging economies. At first these experiences may suggest a shortcoming of our approach, because many of these surplus countries also experienced steep increases in income inequality. But on closer inspection this case actually strengthens our results, as long as the model is appropriately modified to take account of the fact that typical emerging economies are characterized by what is commonly referred to as "financial market imperfections". This means that in such economies workers cannot borrow from investors when their income share declines. Instead they have to reduce their consumption (relative to an often fast-growing trend, of course). In such economies higher inequality necessitates an export-oriented growth model, where the domestic wealthy end up deploying their additional income in foreign rather than domestic financial assets. Reduced domestic demand, and investment in foreign financial assets that supports foreign demand, imply current account surpluses instead of deficits.

A short-sighted response to global imbalances could therefore be to reduce these "financial market imperfections" in surplus countries. However, if lending is liberalized without addressing the underlying income inequalities, it will result in a globalized rather than a regional increase in

domestic indebtedness of the poor and middle class. While this would reduce cross-border debt levels, it would result in larger domestic debt levels. We have abstracted from the possibility of crises for the purpose of this paper, but higher debt levels would very likely increase the vulnerability to crises, as in Kumhof and Rancière (2010). In the long run, there is therefore simply no alternative to addressing the income inequality problem itself. Doing so would simultaneously reduce the tendency towards current account deficits in financially developed countries and towards current account surpluses in financially less developed countries.<sup>17</sup>

Many of the policy options for reducing income inequality, which involve either reducing workers' relative tax burdens or strengthening their bargaining power over wages, are fraught with difficulties [Kumhof and Rancière (2010)]. For taxes, these include the danger of driving investment to other jurisdictions if reductions in labor income taxes are financed through increases in capital income taxes. Solutions might include more progressive labor income taxes that leave average tax rates unchanged [Piketty et al. (2011)], or alternatively financing lower labor income taxes across all income levels through higher taxes that do not distort economic incentives. This includes appropriately designed taxes on unearned income or rents, specifically on profits from investments in land, natural resources, and the financial sector. Directly strengthening the bargaining power of workers could be problematic because of international goods and labor market competition, but this must be weighed against the potentially very serious consequences of further financial crises if nothing is done to deal with income inequality and the resulting high debt levels.

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<sup>17</sup>Of course we do not claim that this would eliminate current account imbalances entirely.

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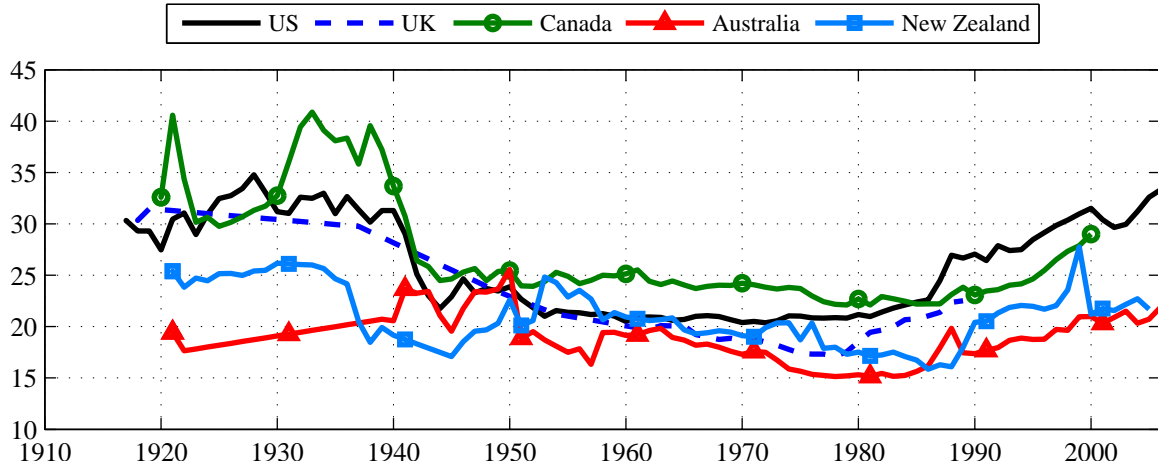
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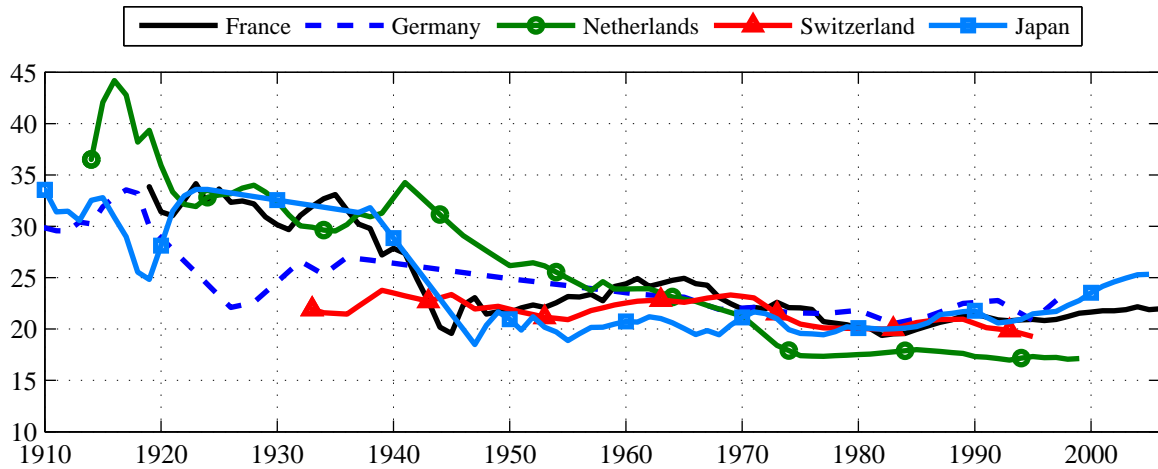


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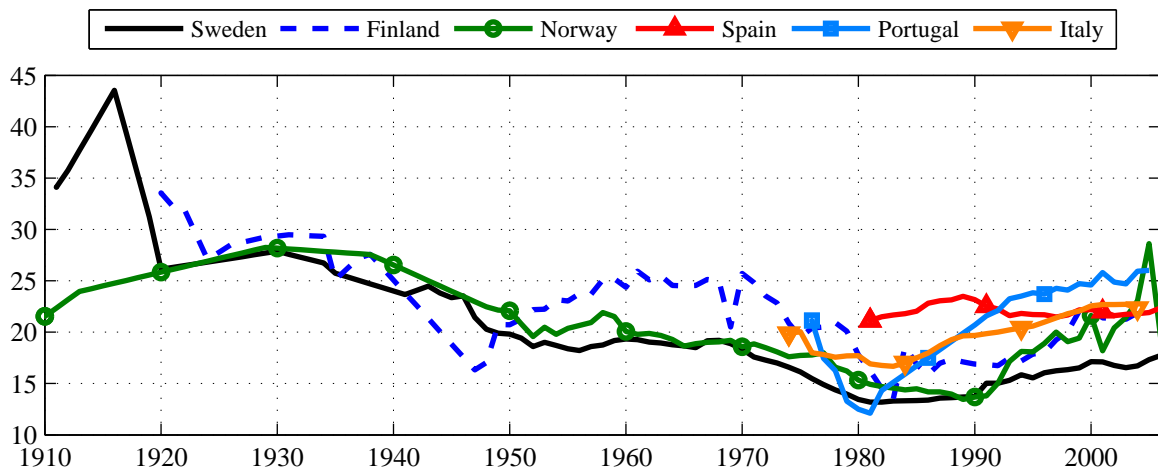
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(a) Anglo-Saxon Countries (U-shaped)

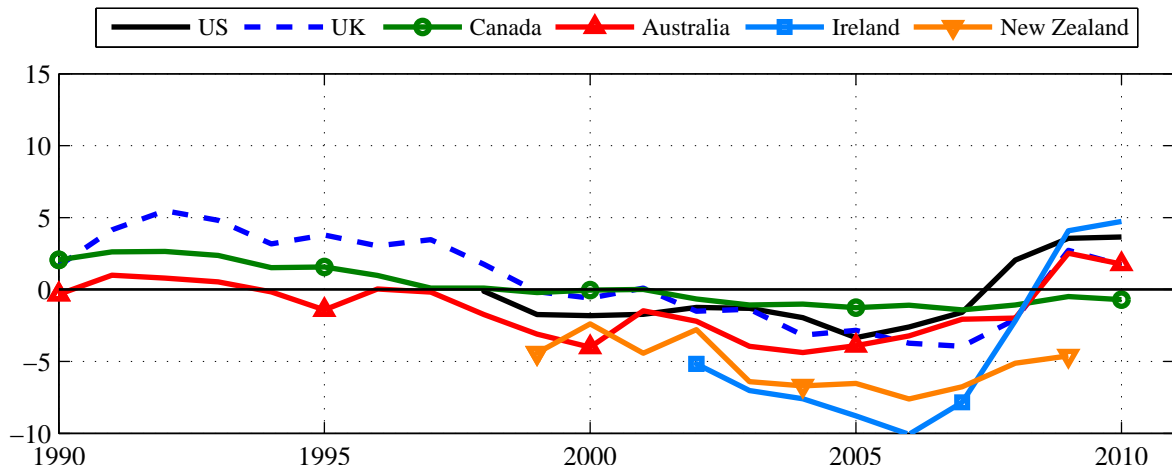


(b) Continental Europe and Japan (L-shaped)

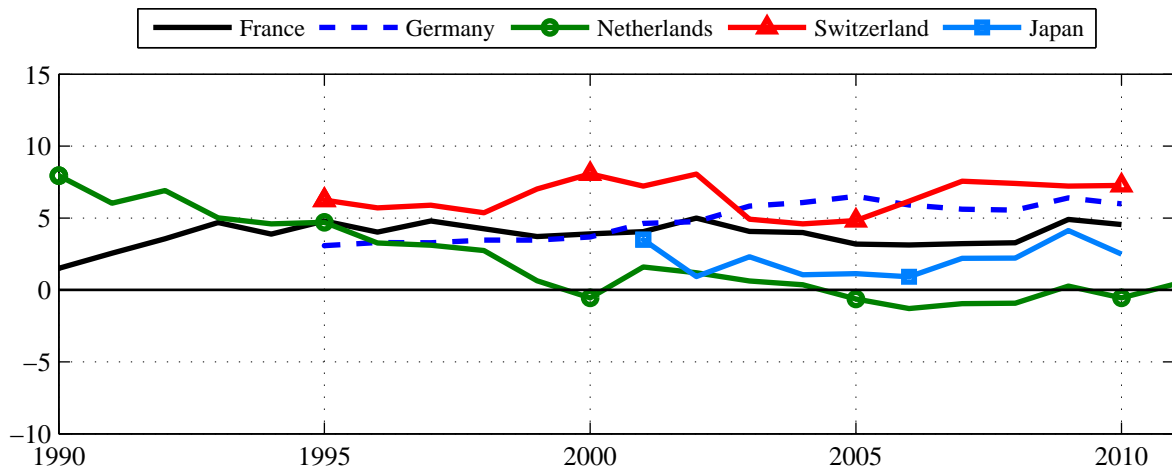


(c) Southern Europe and Nordic Countries (U/L-shaped)

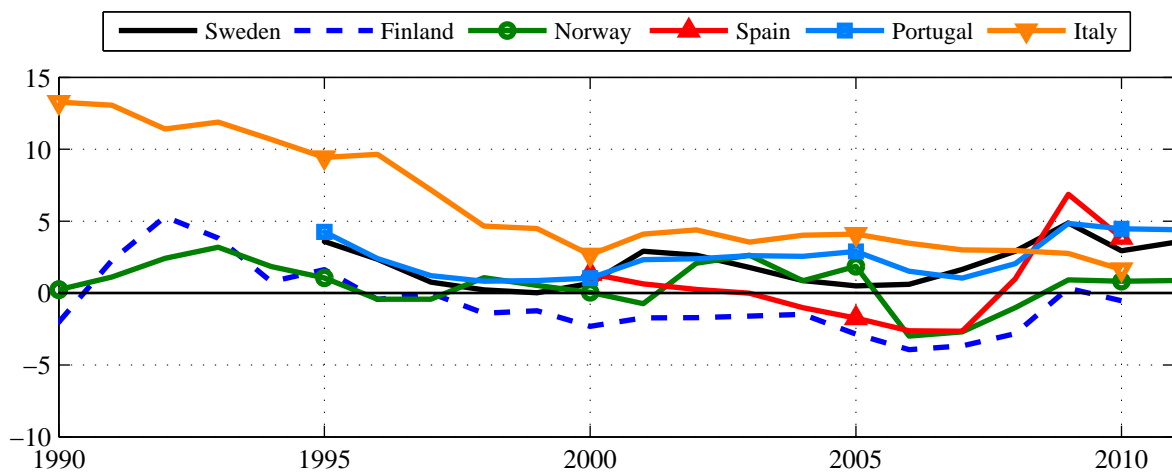
Figure 1: Income Share of Top 5 Percent by Country (in percent)



(a) Anglo-Saxon Countries (U-shaped)

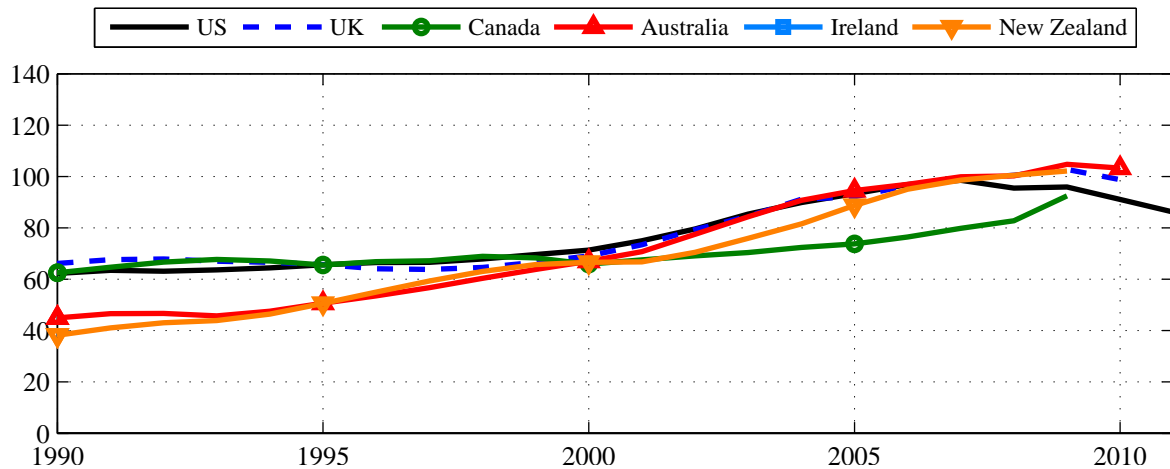


(b) Continental Europe and Japan (L-shaped)

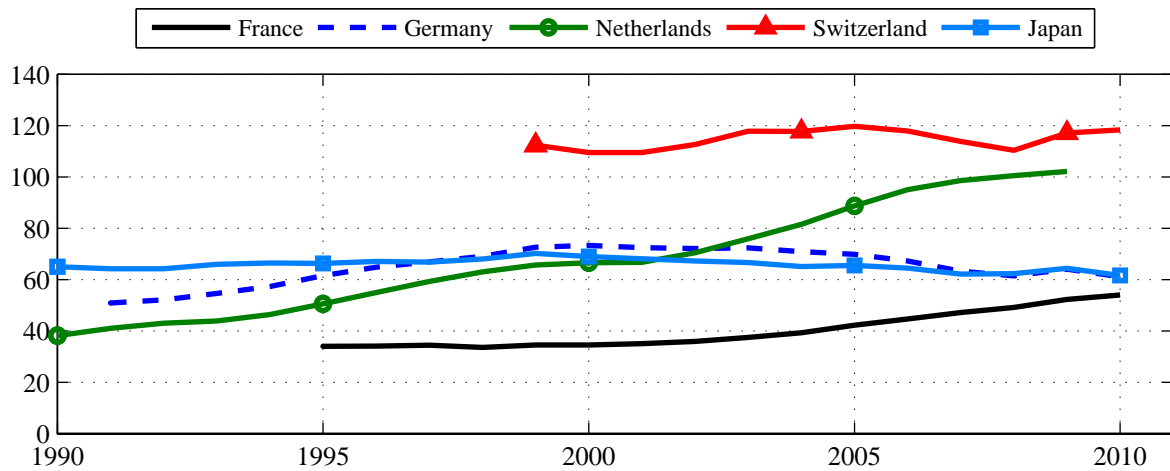


(c) Southern Europe and Nordic Countries (U/L-shaped)

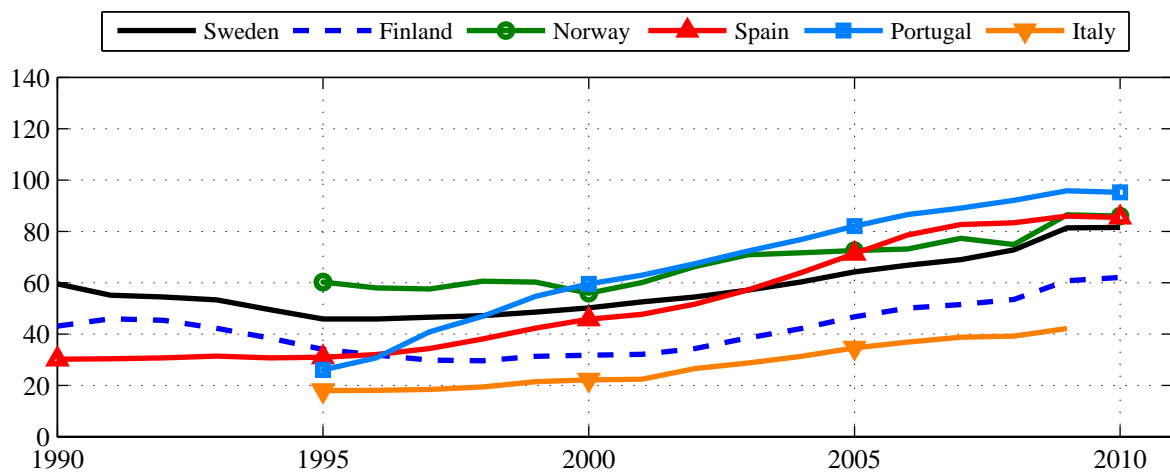
Figure 2: Net Lending/Borrowing by Households and Non-Profits (percent of GDP)



(a) Anglo-Saxon Countries (U-shaped)

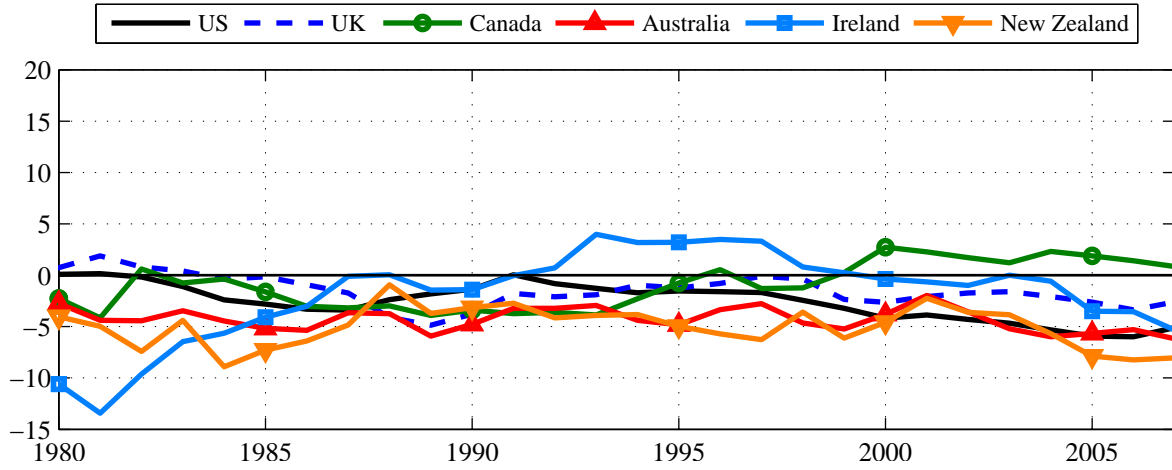


(b) Continental Europe and Japan (L-shaped)

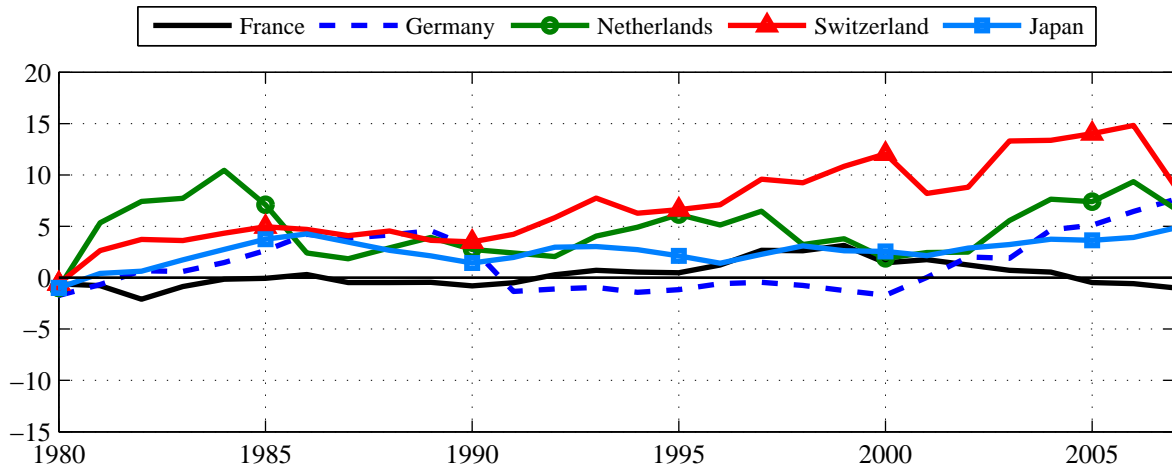


(c) Southern Europe and Nordic Countries (U/L-shaped)

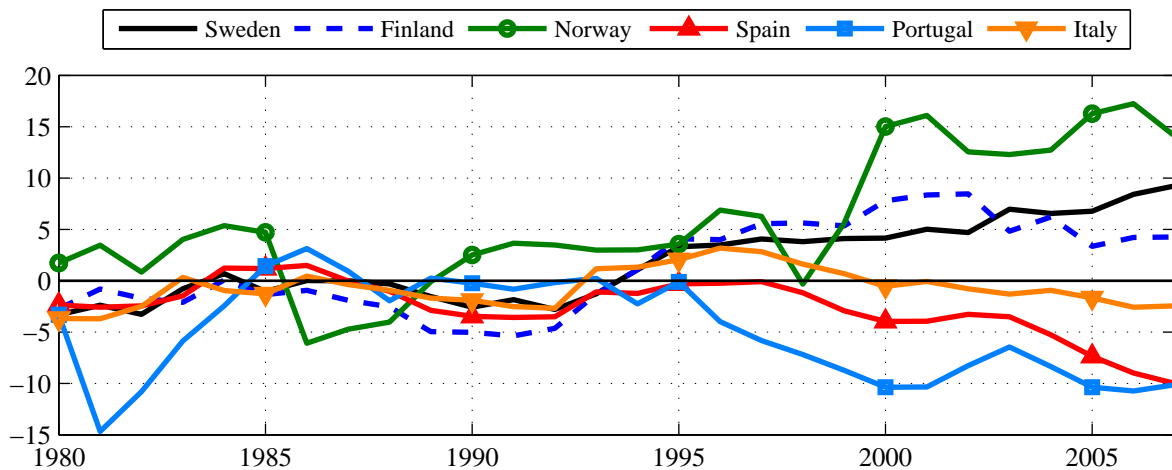
Figure 3: Household Stock of Loans (percent of GDP)



(a) Anglo-Saxon Countries (U-shaped)



(b) Continental Europe and Japan (L-shaped)



(c) Southern Europe and Nordic Countries (U/L-shaped)

Figure 4: Global Current Account Imbalances (percent of GDP)

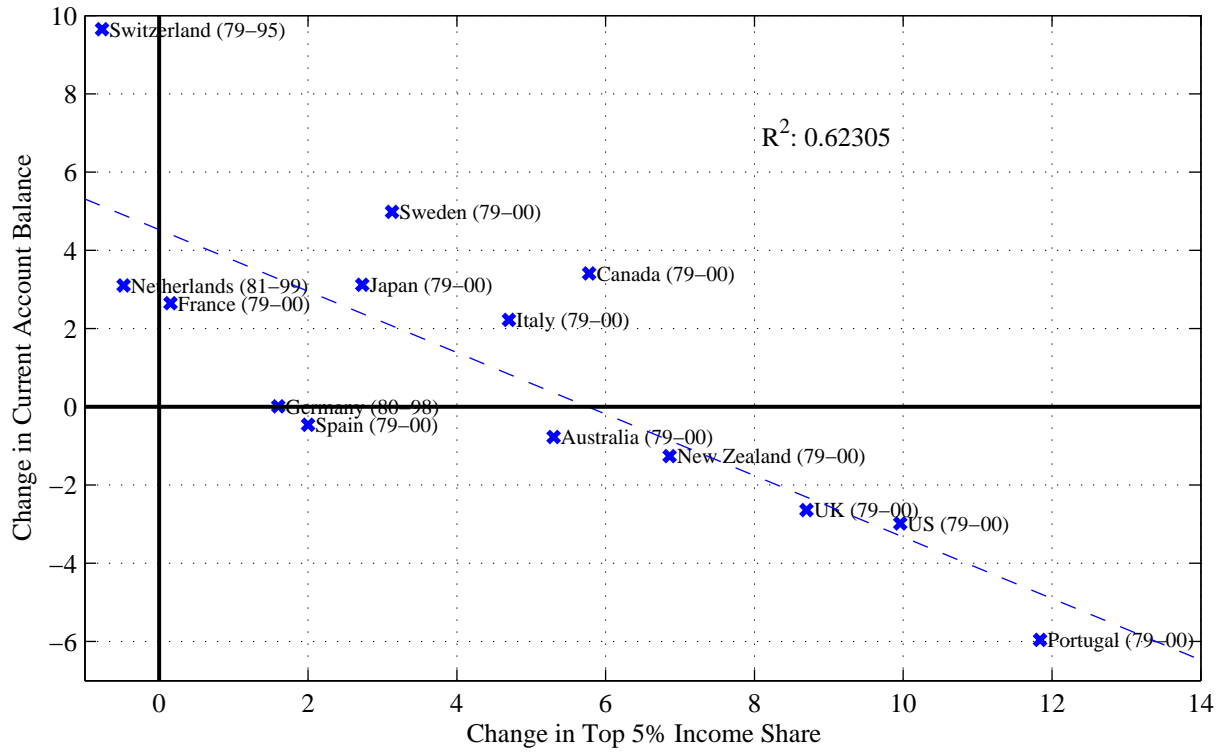


Figure 5: Changes in Current Accounts and Top Income Shares (in percent)

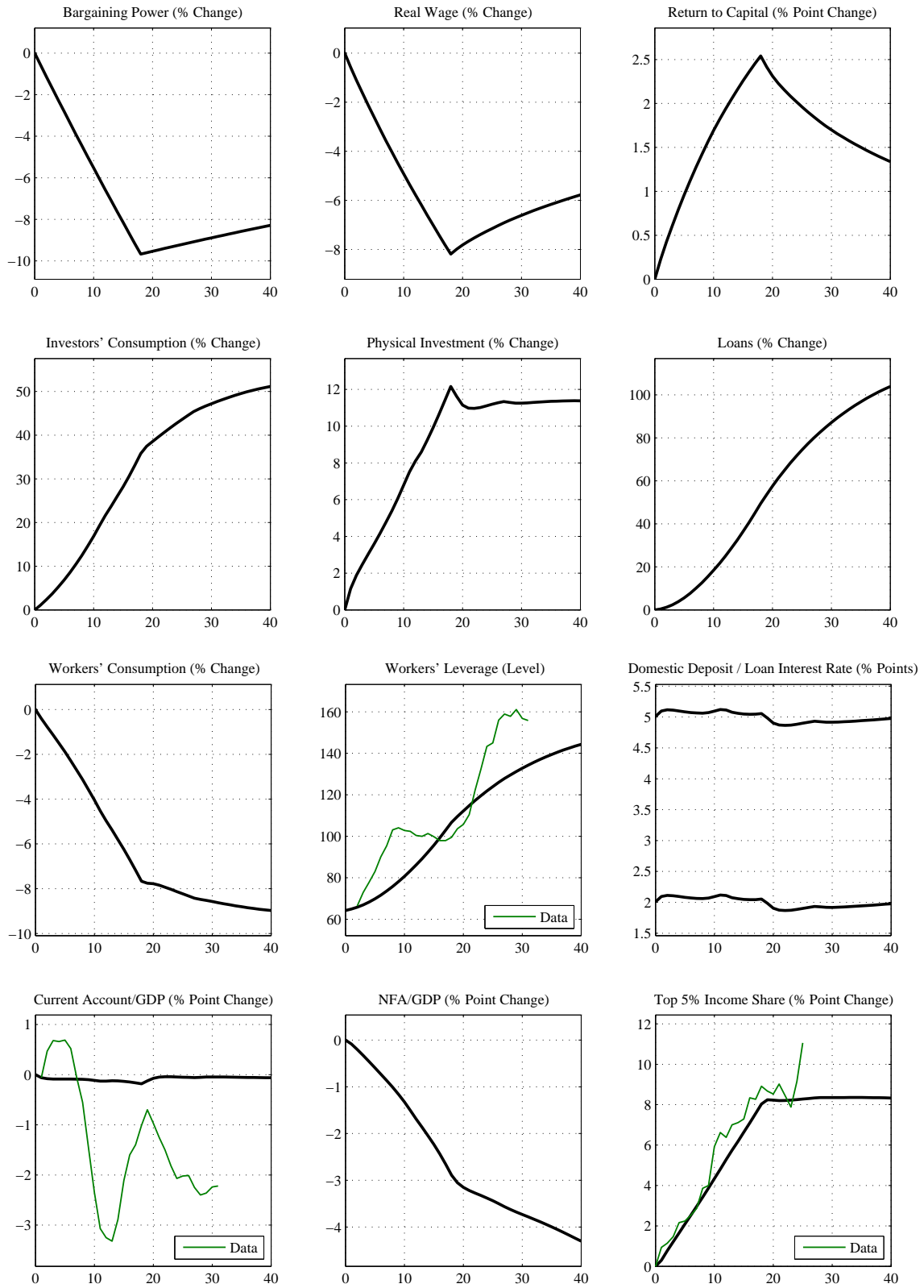


Figure 6: Increased Inequality



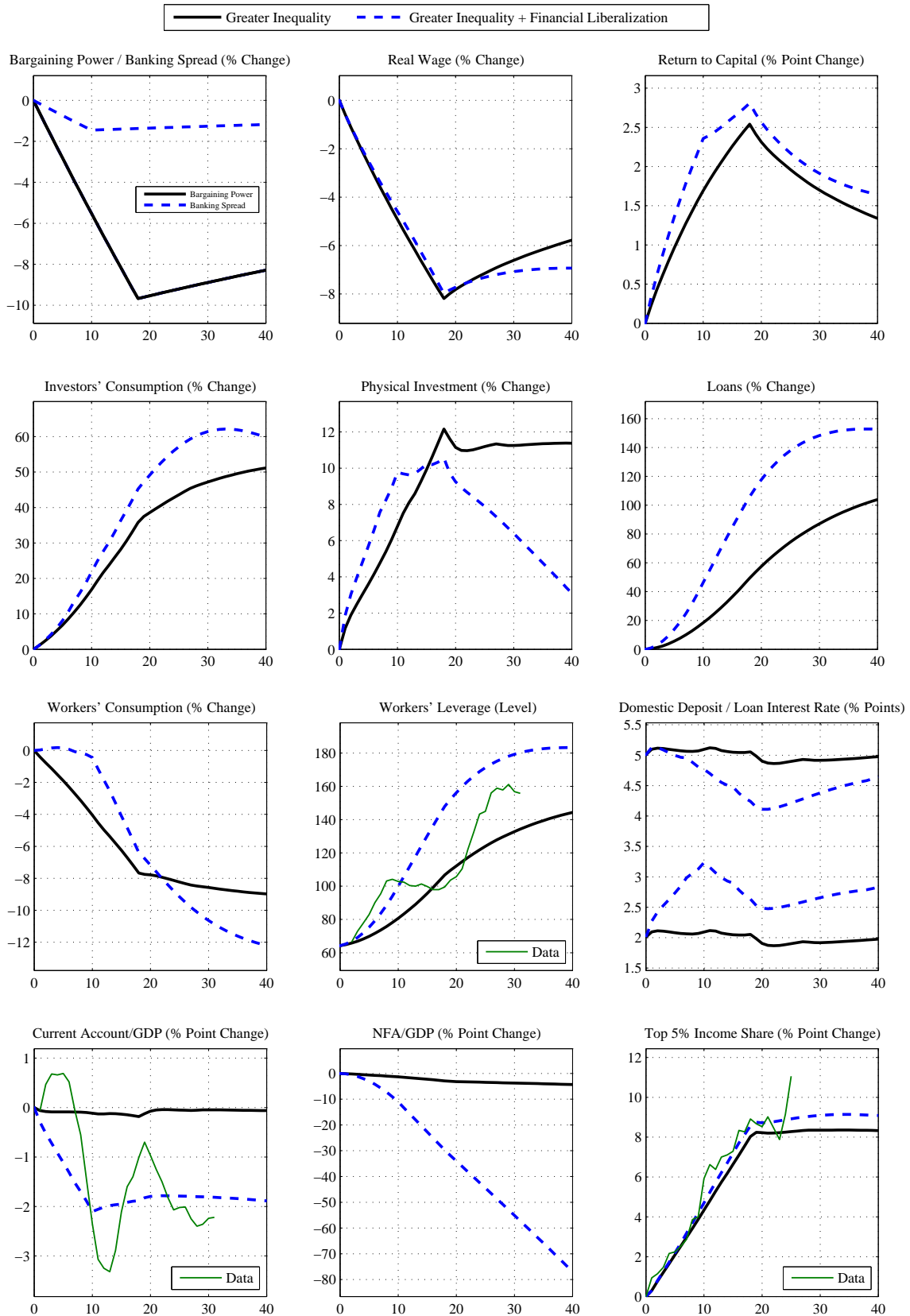


Figure 7: Increased Inequality Accompanied by Financial Liberalization

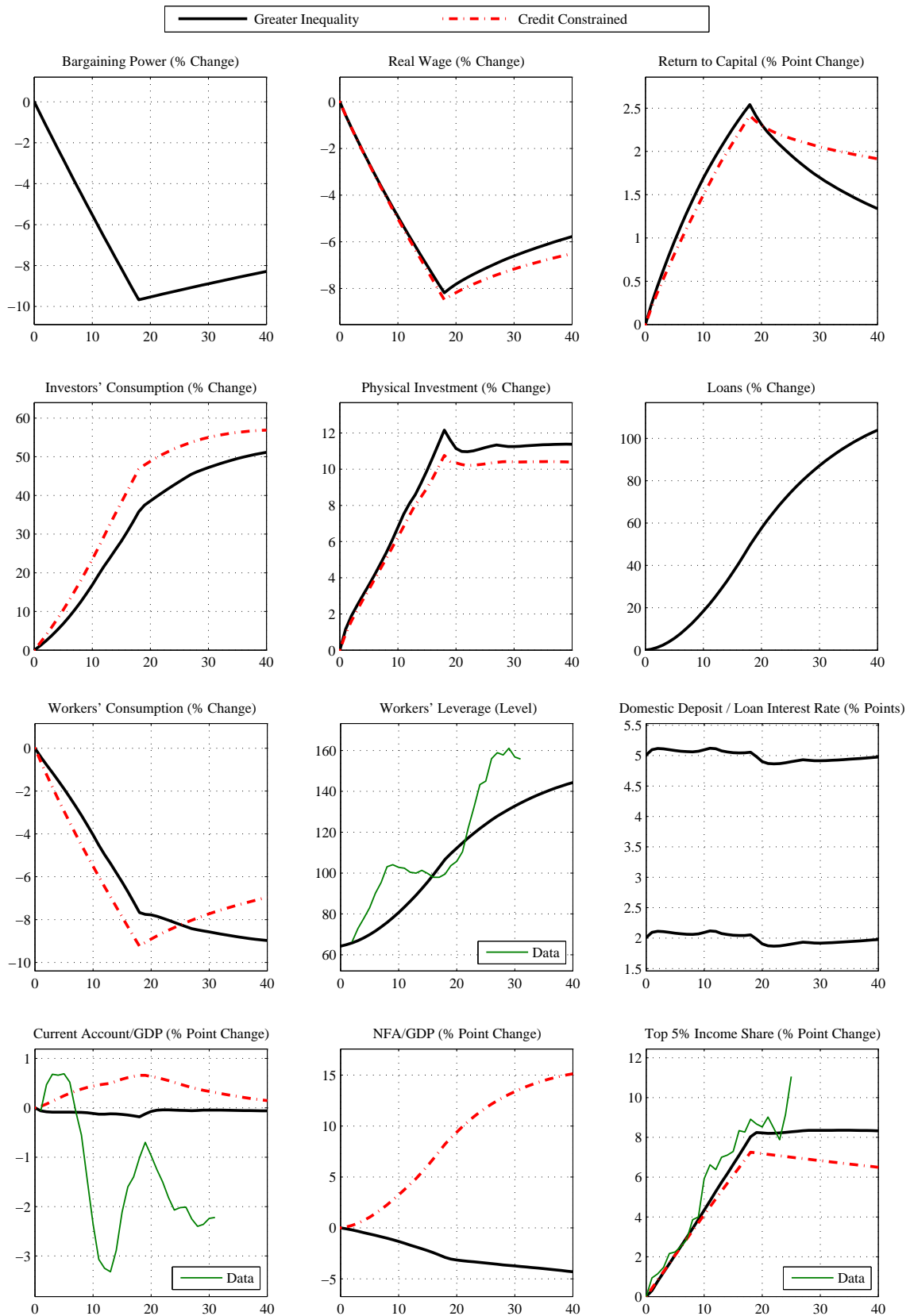


Figure 8: Emerging Economies: The Role of Credit Constraints

Table 1: Variable Definitions &amp; Sources for Panel Estimation\*

Variables	Definition and construction	Source
Top 1% and 5% income share	Share of income of the top 1% and 5% of the income distribution	The World Top Incomes Database
CA (% of GDP)	Current Account Balance, ratio to GDP	World Economic Outlook (2011)
NFA (% of GDP)	Stock of Net Foreign Assets, ratio to GDP	Lane & Milesi-Ferretti
Gov balance shock (% of GDP)	Fiscal consolidation through taxes and government spending, percent of GDP	D. Leigh Dataset of Fiscal Consolidation
Relative income	Per capita income, adjusted by PPP exchange rates, measured relative to the U.S. (range 0 to 1)	Penn World Table (2010)
Youth dependency ratio	Youth dependency ratio, population under 15 relative to the population between 15 and 65	World Development Indicators (2010)
Old dependency ratio	Old dependency ratio, population over 65 relative to the population between 15 and 65	World Development Indicators (2010)
Average GDP growth	Average real GDP growth	World Development Indicators (2010)
Terms of trade	Terms of trade and terms of trade volatility	World Development Indicators (2010)
Trade (% of GDP)	Openness indicator: ratio of exports plus imports of goods and non factor services to GDP	World Development Indicators & International Financial Statistics (2010)
Private credit (% of GDP)	Ratio of private credit to GDP, decomposed into private credit from deposit money banks and private credit from non-bank	World Bank Fin. Structure Database (2011)

\* Panel consists of Australia, Canada, France, Germany, Italy, Japan, the Netherlands, New Zealand, Portugal, Spain, Sweden, Switzerland, the United Kingdom & the United States.

Table 2: Additional Variable Sources

Variable	Source
Net lending/borrowing (figure 2)	OECD Dataset 14A: Non-financial accounts by sectors Sector <i>S14_S15</i> : Households and non-profit institutions serving households except for Australia, Canada & New Zealand: Statistics Canada Sector accounts, persons and unincorporated businesses Table 380-0004 Statistics New Zealand. Table reference: ISA029AA Australian System of National Accounts, Table 40. Household Financial Account, Current prices, Series A2422034R
Stock of Loans (figure 3)	OECD Households Assets Sector <i>S14_S15</i> : Households and non-profit institutions serving households

Table 3: ARDL DFE Estimation<sup>†</sup> (Dependent variable: CA (% of GDP))

Variables	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5	Regression 6
Long-Run Coefficients						
Top 5% income share	-0.190*** (0.0560)		-0.168*** (0.0643)		-0.159** (0.0727)	
Top 1% income share		-0.329** (0.136)		-0.350*** (0.0413)		-0.400*** (0.0490)
Private credit: banks (% of GDP)	-0.0319** (0.0139)	-0.0302* (0.0178)	-0.0390* (0.0237)	-0.0364 (0.0291)	-0.0294 (0.0195)	-0.0308 (0.0232)
Private credit: non-banks (% of GDP)	-0.0563** (0.0246)	-0.0507* (0.0275)	-0.0641*** (0.0187)	-0.0630*** (0.0185)	-0.0517** (0.0228)	-0.0497** (0.0227)
Youth dependency ratio			8.686*** (3.360)	9.838** (3.890)	7.903** (3.729)	8.163* (4.194)
Old dependency ratio			-1.454 (3.511)	-1.163 (3.832)	-3.891 (4.225)	-3.724 (4.539)
Trade (% of GDP)			0.111** (0.0526)	0.121** (0.0533)	0.167** (0.0648)	0.180*** (0.0648)
Error Correction Coefficients						
$\phi$ (Convergence coefficient)	-0.336*** (0.0556)	-0.329*** (0.0537)	-0.340*** (0.0859)	-0.344*** (0.0967)	-0.319*** (0.0957)	-0.328*** (0.115)
Short-Run Coefficients						
Lag 1 of $\Delta$ CA (% of GDP)	0.130 (0.0876)	0.115 (0.0871)	0.270*** (0.0931)	0.256** (0.1000)	0.196*** (0.0583)	0.179*** (0.0668)
Lag 2 of $\Delta$ CA (% of GDP)	0.0180 (0.0601)	0.00959 (0.0616)	-0.0483 (0.0560)	-0.0390 (0.0606)	-0.0932 (0.0595)	-0.0909 (0.0608)
$\Delta$ Top 5% income share	0.128 (0.0820)		0.191 (0.135)		0.117 (0.0770)	
$\Delta$ Top 1% income share		0.0616 (0.106)		0.159 (0.232)		0.110 (0.127)
Gov balance shock (% of GDP)			0.232* (0.130)	0.217 (0.142)	0.197 (0.149)	0.175 (0.162)
$\Delta$ Relative income					-0.000837*** (0.000299)	-0.000869*** (0.000328)
$\Delta$ Trade (% of GDP)					-0.0447 (0.0433)	-0.0452 (0.0502)
$\Delta$ GDP growth					0.0366 (0.116)	0.0427 (0.126)
$\Delta$ NFA (% of GDP)					0.0654** (0.0288)	0.0707** (0.0346)
Intercept	0.681* (0.354)	0.288 (0.389)	-0.179 (0.415)	-0.412*** (0.0984)	-0.338 (0.438)	-0.420** (0.167)
Observations	415	382	415	382	415	382
Countries	14	13	14	13	14	13

<sup>†</sup> Estimation based on a Dynamic Fixed Effect-ARDL(2, 1) specification. Robust standard errors are in parentheses. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$

Table 4: ARDL PMG Estimation<sup>†</sup> (Dependent variable: CA (% of GDP))

Variables	Regression 1	Regression 2	Regression 3	Regression 4	Regression 5	Regression 6
Long-Run Coefficients						
Top 5% income share	-0.123** (0.0606)		-0.204*** (0.0578)		-0.221*** (0.0486)	
Top 1% income share		-0.179** (0.0817)		-0.311*** (0.0707)		-0.327*** (0.0678)
Private credit: banks (% of GDP)	-0.0198** (0.00936)	-0.0212** (0.00986)	-0.00199 (0.0137)	0.00166 (0.0131)	-0.0683*** (0.0109)	-0.0658*** (0.0102)
Private credit: non-banks (% of GDP)	-0.0445*** (0.0103)	-0.0437*** (0.00989)	-0.0248* (0.0134)	-0.0257** (0.0122)	-0.0197 (0.0193)	-0.0188 (0.0182)
Youth dependency ratio			-12.13** (5.554)	-6.252 (5.325)	-5.440* (3.214)	-3.130 (2.970)
Old dependency ratio			-16.32*** (3.757)	-13.76*** (3.453)	1.522 (2.667)	1.473 (2.553)
Trade (% of GDP)			0.144*** (0.0386)	0.145*** (0.0366)	0.313*** (0.0492)	0.299*** (0.0487)
Error Correction Coefficients						
$\phi$ (Convergence coefficient)	-0.354*** (0.105)	-0.379*** (0.105)	-0.411*** (0.120)	-0.438*** (0.126)	-0.307*** (0.0956)	-0.317*** (0.0986)
Short-Run Coefficients						
Lag 1 of $\Delta$ CA (% of GDP)	0.305*** (0.0861)	0.322*** (0.0738)	0.245*** (0.0691)	0.262*** (0.0638)	0.104 (0.0717)	0.111 (0.0826)
$\Delta$ Top 5% income share	0.617 (0.468)		0.586 (0.535)		0.243 (0.441)	
$\Delta$ Top 1% income share		0.479 (0.659)		0.654 (0.729)		-0.772 (0.629)
Gov balance shock (% of GDP)			0.686* (0.363)	0.696* (0.390)	0.270 (0.355)	0.315 (0.353)
$\Delta$ Relative income					-0.000776*** (0.000265)	-0.000710*** (0.000266)
$\Delta$ Trade (% of GDP)					-0.0883* (0.0526)	-0.0693 (0.0533)
$\Delta$ GDP growth					-0.0829 (0.0806)	-0.0765 (0.0831)
$\Delta$ NFA (% of GDP)					0.0861*** (0.0164)	0.0865*** (0.0245)
Intercept	-0.265 (0.599)	-0.652 (0.689)	-0.386 (0.584)	-1.186 (0.742)	-0.231 (0.934)	-0.784 (1.074)
Observations	239	239	239	239	239	239
Countries	10	10	10	10	10	10

<sup>†</sup> Estimation based on a Pooled Mean Group-ARDL(2, 1) specification. Robust standard errors are in parentheses. \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$