

Income Inequality and Current Account Imbalances

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Abstract

Current account regressions show that when top income shares are added to the comprehensive set of conventional explanatory variables used by the IMF, they predict significantly larger current account deficits in a cross-section of advanced economies, but with important outliers among countries that have pursued export-led rather than finance-led growth strategies. To study this mechanism, we develop a DSGE model where the income share of top earners increases at the expense of bottom earners. Due to preferences for wealth, top earners have a much higher marginal propensity to save than bottom earners, as they do in the data. We find that, when the redistributive shock has a large positive effect on asset values, and if domestic financial markets are large, the result will be a sizeable current account deficit. On the other hand, when the redistributive shock mostly affects relative labor incomes, and if domestic financial markets are small, the result will be a current account surplus.

Keywords: Current account imbalances; income inequality; financial liberalization

JEL Classifications: E2, F32, F41

1 Introduction

Global external imbalances were a major source of financial sector fragility in the run-up to the 2007/8 worldwide financial crisis. Several authors, including Obstfeld and Rogoff (2009), Blanchard (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.¹ For U.S. current account deficits, the pre-crisis concern centred 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.² 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,³ 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 can make progress towards explaining the deeper structural reasons for persistently large current account deficits.

We argue in this paper that a major factor that unites the experiences of most countries with external imbalances is a steep increase in income inequality over recent decades. We find that, both in our empirical work and in our model simulations, greater income inequality, under plausible calibrations and assumptions about the structure of the economy, exhibits a clear link to changes current accounts.

Our paper does not take a stand on the question of the origins of this increase in income inequality. 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). There is however a large empirical literature on this question, with many competing hypotheses, of which we now provide a brief overview. For the United States, the empirical evidence in Philippon (2008) and Philippon and Reshef (2008) shows that a substantial part of the observed increase in inequality was due to steeply increasing financial sector incomes 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. As to other explanatory factors, for the United States, Lemieux, MacLeod and Parent (2009) find that an increase in the share of performance pay (e.g. bonuses) can explain 20% of the growth in the variance of male wages between the late 1970s and the early 1990s, and almost all of the growth in wage inequality at the very top end of the income distribution. Lemieux (2006) shows that the dramatic increase in the return to post-secondary education plays an important role in the

¹Other 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 (BIS (2008)).

²See Obstfeld and Rogoff (2001), Roubini and Setser (2004), Mann (2011) and Mussa (2004).

³The 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).

increase in income inequality and can explain why wage gains are disproportionately concentrated at the top of the distribution. Card, Lemieux and Riddell (2004) find that changes in unionization can explain around 14% of the growth in the variance of male earnings in the United States. Borjas and Ramey (1995) and Roberts (2010) point to the role of foreign competition and jobs offshoring in the rise of income inequality. Finally, Hacker and Pierson (2010) stress the role of government intervention in support of the rich.

Our data and cross-country econometric analysis shows that increases in income inequality account for a very large part of observed current account deteriorations in a large cross-section of countries, including the United States or the United Kingdom, and that this result is very robust to the inclusion of other control variables. However, there are important outliers, most importantly among countries that have pursued an export-led rather than a finance-led growth model. In these cases, which include China and Germany, current accounts improved despite significantly higher income inequality.

Our theoretical analysis is designed to help us understand these empirical results. We lay out a two-country, one-good dynamic stochastic general equilibrium (DSGE) model where changes in current accounts arise endogenously in response to *permanent* changes in domestic income inequality. The model features two distinct household groups. Top earners have a much higher propensity to save out of additional current income, as they do in the data. Top earner preferences for tradable wealth, including both shares and bonds, allow the model to reproduce this feature, as in Kumhof, Rancière and Winant (2015), while domestic and foreign bottom earners are assumed to have standard consumption preferences to match their empirically much lower marginal propensity to save. This means that the saving behavior of top earners, in other words the supply side of the credit market, determines the main results of our simulations.

In these simulations, it turns out to be critical whether the country in question has large credit, stock and housing markets, and whether the inequality shock represents a redistribution of bottom earner income towards top earner non-financial income, which we will refer to as labour income, or towards top earner income derived from financial assets, which we will refer to as dividend income. Countries with large credit, stock and housing markets, and with redistribution predominantly towards top earner dividend income, experience current account deficits, while countries with small credit, stock and housing markets, and with redistribution predominantly towards top earner labour income, experience current account surpluses.

When top earners receive a permanent increase in their labour income, this increases the long-run desired levels of not only their consumption but also of their tradable wealth. The latter includes not only shares but also financial assets that ultimately represent loans to both domestic and foreign bottom earners. The wealth accumulation motive causes interest rates to drop during a lengthy transition period. Absent this drop in interest rates, domestic and foreign bottom earners would simply respond to permanently lower income by immediately and permanently reducing their consumption. But when interest rates drop, they borrow instead. Because this borrowing also happens among foreign households, this generates a domestic capital account deficit, and thus a current account surplus. These effects are weakened by the presence of large domestic financial markets, first because with large stock and real estate markets the drop in real interest rates boosts asset values, thereby reducing the need to accumulate additional assets through current account surpluses, and second because with large domestic credit markets a large share of top earners' desired savings can be absorbed by domestic bottom earners, rather than foreigners, going more deeply into debt. Conversely, of course, with small domestic credit, stock and real estate mar-

kets, current account surpluses become larger. This may contribute to an explanation of the fact that countries with export-led rather than finance-led growth models, such as Germany and China, have experienced current account surpluses in response to higher domestic income inequality.

When top earners receive a permanent increase in their dividend income at the expense of bottom earners' labour income, this has an immediate effect on the value of their tradable wealth that is so large that it exceeds the increase in their desired long-run level of wealth. As a result of feeling richer, they start to consume part of the additional wealth. They do so mainly by borrowing from foreigners, because domestic bottom earners do not wish to lend on a significant scale. This represents a capital account surplus and thus a current account deficit. This deficit becomes larger when the share of stock and real estate markets in the domestic economy is large. This may contribute to an explanation of the fact that countries with finance-led growth models, such as the Anglo-Saxon countries, have experienced current account deficits in response to higher domestic income inequality.

Our work builds on Kumhof, Rancièrè and Winant (2015), 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 bottom earners (defined as the bottom 95% of the population ranked by income) relative to top earners (the top 5%). The perception that household indebtedness had become unsustainably high was a key factor that contributed to eventually triggering these crises. Kumhof, Rancièrè and Winant (2015) present a DSGE model where an inequality-driven financial crisis arises endogenously. High leverage occurs several decades after the onset of a permanent shock to relative incomes that favours top earners at the expense of bottom earners. This shock increases credit supply at the top of the income distribution due to a wealth accumulation motive as in Carroll (2000). In other words, top earners recycle their income gains back to bottom earners through interest-bearing loans that grow over a period of decades.

Kumhof, Rancièrè and Winant (2015) replicate several important U.S. stylized facts for the 1983-2007 period, including a sharply increasing debt-to-income ratio of the bottom 95% of the income distribution and a sharply increasing probability of a major financial crisis. However, their prediction of a constant aggregate consumption level (except during crises) is counterfactual, and is due to their choice of a model with a closed endowment economy. This is in contrast to the U.S. credit-fuelled consumption boom, which included a strong import boom and was therefore accompanied by current account deficits. This paper extends the framework of Kumhof, Rancièrè and Winant (2015) to an open economy setting to address this concern.

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 a proxy for income inequality 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. 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).⁴ 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 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, Ranci re and Winant (2015) provide a general equilibrium model, and show why an increase in credit that follows a permanent shock to the income distribution must be driven by credit supply rather than credit demand.

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, 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.

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, as in Carroll (2000). We see our analysis as complementing the financial accelerator literature, by focusing the

⁴Berg and Ostry (2011) find, in a cross-section of countries, that countries with greater income inequality exhibit growth spells that are more frequently interrupted by growth breakdowns.

explanation for high household debt levels on the empirically well-documented heterogeneity in incomes, rather than heterogeneity in patience.

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.⁵

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. Our analysis shares with these papers a focus on credit market developments, but our focus is entirely on the roots of such developments in either increasing income inequality or increasing the macroeconomic effects of greater income inequality.

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. Section 3.2 and Section 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 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 (Atkinson and Piketty (2007, 2010)), and in the world top incomes database.⁶ 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

⁵On 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.

⁶This 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.

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 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. 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.⁷ 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, Ranci ere and Winant (2015) 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.

⁷This 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.

The United Kingdom, starting in the late 1980s, 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 (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%.

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 and Mas (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 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,⁸ 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.

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

⁸Bach 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.

magnitude, of this relationship will survive the introduction of numerous control variables in our econometric analysis. Germany is an outlier in this relationship, and furthermore the correlation vanishes when emerging economies are included. A strength of our theoretical model is that it offers explanations for both facts, where the key difference between deficit and surplus countries is the state of development of domestic financial markets and the importance of shocks that affect asset valuations rather than relative labour incomes.

3.4 Econometric Analysis

In this subsection we report estimation results for current account regressions that include income inequality, as measured by top income shares, as one of the explanatory variables. Our empirical strategy builds on the IMF's External Balance Assessment (EBA) methodology (IMF, 2013). The EBA is considered to be the most comprehensive approach for understanding the determinants of current accounts. Therefore the finding of *an additional effect* of income inequality on the current account would be unlikely to be plagued by an omitted variable bias.

Following EBA, the estimation uses pooled GLS with a panel-wide AR(1) correction. Because current account data display strong autocorrelation, it is important to take account of this in the estimation. An alternative to panel-wide AR(1) correction would be to introduce a lag of the current account in the regression. However, in pooled data this would amount to adding a quasi-fixed effect to the estimates, and it would open up a key interpretation issue related to having the current account in a given year being explained by the previous years current account. Specifically, with such a specification the lagged current account regressor could end up picking up the effects of sustained distortions that are otherwise not captured by the regression, rather than serving its intended purpose of picking up dynamics and gradual adjustment. The use of pooled GLS with a panel-wide AR(1) avoids this problem.

The variables included in the EBA specification capture productivity and the level of development (interacted with capital account openness), the expected GDP growth rate 5 years ahead based on the IMF's World Economic Outlook (WEO) forecast, a country's lagged net foreign assets to GDP ratio, measures of exhaustible resources of oil and natural gas, demographic factors, financial centre status, risk associated with the institutional/political environment, reserve currency status (the share of a country's own currency in the total stock of world reserves), global capital market conditions, or global risk aversion, proxied by the VIX/VXO index, private credit to GDP ratios (relative to own historical average), the relative output gap, the commodity terms of trade (TOT), the cyclically-adjusted fiscal balance, the level of public expenditures on health relative to GDP, and foreign exchange (FX) intervention interacted with capital controls. The precise definition of variables and the rationale for including each of them is provided in IMF (2013).

The EBA regressions are run using annual data for a sample of 49 countries over the period 1986-2010. Table 1, col. 1, presents the replication of the EBA regressions for the restricted sample of 19 OECD countries, which is the more relevant sample for considering top income shares.

For this paper, the top income share variables, which come from the World Top Incomes database, are added to the EBA specification for the 19 OECD countries.⁹ The top income shares considered are the Top 10%, Top 5%, Top 1%, and Top 0.1%, respectively. The regression results

⁹For the OECD countries, the top income share measures are available for the full sample period. Outside the OECD, annual data are available only for a handful of countries, and always only for a subset of top income share variables.

are presented in Table 1. columns 2 to 5. Despite the very rich EBA baseline specification, all the top income share variables are significant at either the 5% or 1% confidence level, except the Top 1%. The economic effects are also sizeable. A 10 percentage points increase in the top 5% income share, which is of the magnitude experienced in the US over the period 1986-2010, is associated with a worsening of the current account deficit by 1.25 percentage points. Interestingly, the estimates for the other regressors are very similar to those obtained in Table 1, column 1, for the same sample of OECD countries. This suggests that top income shares have a clear effect on the current account, above and beyond the EBA baseline results.

Table 2 interacts the top income shares with a proxy for the size of domestic financial markets, the private credit to GDP ratio. This tests whether the negative relationship between the current account and inequality becomes stronger in countries with larger financial markets. The interaction terms are all significant at the 1% or 5% confidence levels, suggesting that indeed the negative relationship between current accounts and income inequality becomes stronger with the degree of financial development.

We emphasize that both of these results, on the negative effects of income inequality on current accounts in the average OECD economy, and on the importance of the size of domestic financial markets in this relationship, are qualitatively consistent with the simulation results for our theoretical model in the following section.¹⁰

4 The Model

The world economy consists of two countries, Home and Foreign, with Home's share of the world population given by ω , and with Foreign variables identified by a superscript asterisk. Within each country there are two groups of households, bottom earners, identified by subscripts b , and top earners, identified by subscripts τ . The share χ of top earners in the population of each country equals 5%, or $\chi = 0.05$. Both model economies are symmetric except for their relative size (and in the current draft countries are assumed to be of equal size). There is a single tradable world good, and all income is received by way of endowment flows. The total endowment flow a_t is partly received as the return $a_t y_t n_{t-1}$ on a tradable asset (a Lucas tree) that is in fixed supply at $n_t = \bar{n}$, and that is owned exclusively by top earners. For simplicity we will refer to this type of income as dividend income. The remaining endowment flow $a_t (1 - y_t n_{t-1})$ does not derive from tradable assets, and its shares $\zeta_t a_t (1 - y_t n_{t-1})$ and $(1 - \zeta_t) a_t (1 - y_t n_{t-1})$ are received by top earners and bottom earners to reproduce their historical income shares. For simplicity we will refer to this type of income as labour income.

4.1 Endowments

The stochastic process for the total output of the economy is given by

$$\ln(a_t) = (1 - \rho_a) \ln(\bar{a}) + \rho_a \ln(a_{t-1}) + \epsilon_t^a . \quad (1)$$

¹⁰In some important cases they are also quantitatively consistent. However, our work on this is still in progress, and is not yet reported in this draft.

The dividend income fraction of this output is given by¹¹

$$\ln(y_t) = (1 - \rho_y) \ln(\bar{y}) + \rho_y \ln(y_{t-1}) + \epsilon_{y,t} . \quad (2)$$

The share of labour income received by top earners is given by

$$\ln(\zeta_t) = (1 - \rho_\zeta) \ln(\bar{\zeta}) + \rho_\zeta \ln(\zeta_{t-1}) + \epsilon_{\zeta,t} . \quad (3)$$

4.2 Budget Constraints

Two assets are traded in the model economy. The first asset is a consol that can be traded among top and bottom earners and across countries, is denominated in the single world good, trades at price p_t , and pays r units of the consumption good for each unit of the consol held, where we will set $r = 1 - \beta_b$. The respective holdings of this consol by the two domestic household groups are given by $b_{\tau,t}$ and $b_{b,t}$. The second asset is a share that can only be traded domestically by the respective top earners (future versions of the paper will allow for cross-border trade in such shares), is denominated in the single world good, trades at price q_t , pays $a_t y_t$ units of the aggregate consumption good for each unit of the share held, and is in fixed supply at $n_t = \bar{n} = \frac{\chi r}{\bar{a} \bar{y}}$.¹² Finally, the consumption levels of the two household groups are given by $c_{\tau,t}$ and $c_{b,t}$. The budget constraint of bottom earners is

$$c_{b,t} = \frac{a_t (1 - y_t n_{t-1}) (1 - \zeta_t)}{(1 - \chi)} + r b_{b,t-1} - p_t (b_{b,t} - b_{b,t-1}) , \quad (4)$$

while that of top earners is

$$c_{\tau,t} = \frac{a_t (1 - y_t n_{t-1}) \zeta_t}{\chi} + r b_{\tau,t-1} - p_t (b_{\tau,t} - b_{\tau,t-1}) + \frac{a_t y_t n_{t-1}}{\chi} - q_t (n_t - n_{t-1}) . \quad (5)$$

Total wealth of top earners is defined as

$$w_t = n_t q_t + b_{\tau,t} p_t . \quad (6)$$

4.3 Preferences

The instantaneous preferences of bottom earners are given by

$$U(c_{b,t}) = \frac{(c_{b,t})^{1-\sigma}}{1-\sigma} , \quad (7)$$

while instantaneous preferences of top earners are given by

$$U(c_{\tau,t}, w_t) = \frac{(c_{\tau,t})^{1-\sigma}}{1-\sigma} + \varphi \frac{(w_t)^{1-\eta}}{1-\eta} . \quad (8)$$

¹¹For most of our analysis we will assume permanent shocks for the two inequality processes, but we start here with the general notation.

¹²The latter assumption ensures that the returns on consols and shares are equal in steady state.

Bottom and top earners maximize lifetime utility $\sum_{t \geq 0} \beta_b^t U(c_{b,t})$ and $\sum_{t \geq 0} \beta_\tau^t U(c_{\tau,t}, w_t)$. Then we have the stochastic discount factors

$$\psi_{b,t,t+1} = \beta_b \frac{U'_c(c_{b,t+1})}{U'_c(c_{b,t})} , \quad (9)$$

$$\psi_{\tau,t,t+1} = \frac{\beta_\tau \frac{U'_c(c_{\tau,t+1}, w_{t+1})}{U'_c(c_{\tau,t}, w_t)}}{1 - \varphi \frac{U'_w(c_{\tau,t}, w_t)}{U'_c(c_{\tau,t}, w_t)}} . \quad (10)$$

The optimality condition for bottom earners' holdings of consols is

$$p_t = E_t [\rho_{b,t,t+1} (p_{t+1} + r)] . \quad (11)$$

The optimality conditions for top earners' holdings of consols and shares are

$$p_t = E_t [\rho_{\tau,t,t+1} (p_{t+1} + r)] , \quad (12)$$

$$q_t = E_t \left[\rho_{\tau,t,t+1} \left(q_{t+1} + \frac{a_{t+1} y_{t+1}}{\chi} \right) \right] . \quad (13)$$

4.4 Equilibrium and Market Clearing

In equilibrium all four household groups solve their respective optimization problems, and markets clear. To ensure a non-degenerate solution for net foreign asset positions, we assume that the discount factors of domestic and foreign bottom earners are identical, $\beta_b = \beta_b^*$. There is then a unique world interest rate

$$p_t = p_t^* . \quad (14)$$

The market clearing condition for the single world good is given by

$$\omega a_t + (1 - \omega) a_t^* = \omega \chi c_{\tau,t} + \omega (1 - \chi) c_{b,t} + (1 - \omega) \chi c_{\tau,t}^* + (1 - \omega) (1 - \chi) c_{b,t}^* . \quad (15)$$

The market clearing conditions for the two domestic share markets are given by

$$\begin{aligned} n_t &= \bar{n} , \\ n_t^* &= \bar{n}^* . \end{aligned} \quad (16)$$

The market clearing condition for the world market for consols is given by

$$\omega \chi b_{\tau,t} + \omega (1 - \chi) b_{b,t} + (1 - \omega) \chi b_{\tau,t}^* + (1 - \omega) (1 - \chi) b_{b,t}^* = 0 . \quad (17)$$

The net foreign asset position of the domestic economy is then

$$f_t = \omega \chi b_{\tau,t} + \omega (1 - \chi) b_{b,t} , \quad (18)$$

so that the current account of the domestic economy, the key object of interest in our analysis, is given by

$$ca_t = f_t - f_{t-1} . \quad (19)$$

4.5 Preliminary Calibration

All exogenous processes are assumed to be perfectly persistent, $\rho_a = \rho_y = \rho_\zeta = 1$. We calibrate the steady-state levels of technology to be equal to one, $\bar{a} = \bar{a}^* = 1$. We experiment with $\bar{y}\bar{n} \in \{0.1, 0.2\}$, to explore the roles of large versus small domestic stock markets. We set the income share of top-earners to be 25% of total income, so that $\bar{\zeta}$ is defined by $\bar{y}\bar{n} + (1 - \bar{y}\bar{n})\bar{\zeta} = 0.25$. The world real interest rate is $r = 0.04$. We assume an intertemporal elasticity of substitution in consumption of $\sigma = 2.0$, and we set $\beta_\tau = \frac{1}{1+r} - 0.005$. For any intertemporal elasticity of substitution in wealth η , φ is then chosen such that there is no debt in the initial equilibrium. We choose η so that, in partial equilibrium, the marginal propensity to save of top earners is close to 50%, which is close to the value found in Kumhof, Ranci ere and Winant (2015). This produces $\eta = 7$ and $\eta = 8$ for the two values of $\bar{y}\bar{n}$.

4.6 Computational Methodology

Our model is designed to match the persistent growth in income inequality, household debt and external imbalances observed over recent decades in a broad cross-section of countries. Because this can imply highly persistent and large deviations of variables from their initial steady state values, a local solution method can become 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 discretises 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. (2011).

5 Simulation Results

5.1 Effects of a Redistributive Shock to Labour Incomes

In order to study the effects of a redistributive shock to labour incomes, we assume that the size of output that is derived from tradable assets, which we refer to as dividend incomes, is relatively small at $\bar{y}\bar{n} = 0.1$. Figure 6 shows the effects of an immediate permanent increase in the labour income share of domestic top earners by ten percentage points, to 0.35. Given that in this calibration labour income represents 90% of total output, this implies that the labour income of top earners increases by 9% of GDP. Consumption of top earners also increases, initially by 9% of GDP, with continued increases thereafter as the amount of interest received increases. Consumption of bottom earners shows the opposite pattern.

As top earners exhibit preferences for wealth, the increase in their labour income generates a desire to accumulate additional tradable wealth in the form of consols. However, the willingness of bottom earners to borrow and thereby absorb these additional savings is limited, as they only borrow an amount equivalent to 1% of GDP over the first 5 years following the redistributive shock. Domestic top earners therefore also supply additional credit to foreign households. As a result, the domestic economy immediately starts to run a current account surplus equal to 0.40% of GDP,

which gradually declines over time as top earners accumulate sufficient wealth. After the first 5 years, the country has a positive net foreign asset position of 1.5% of GDP.

During this wealth accumulation phase, interest rates drop by 5 basis points, which triggers a 2% increase in the value of tradable output. This increases the value of total top earner wealth without a need to acquire additional assets, and this therefore reduces the demand for consols by top earners. This effect becomes smaller if the relative size of tradeable output, in other words of stock and real estate markets, decreases¹³, thereby leading to larger current account surpluses. The same is true if domestic financial markets are shallow or non-existent, so that domestic top earners cannot lend to domestic bottom earners, thereby forcing them to deploy all their additional savings abroad.

The lessons we learn from this simulation are as follows: First, increases in inequality that affect primarily incomes not derived from tradable assets, primarily labour incomes, lead to an increase in desired wealth holdings by top earners that exceeds the relatively modest increase in the value of their existing wealth triggered by lower interest rates. They therefore lend domestically, but they also export savings, the counterpart of which is a current account surplus. Second, for countries that have small financial markets, including credit, stock and real estate markets, these current account effects will tend to be stronger, first because the wealth revaluation effects become even less important, and second because there is no effective way to channel the additional top earner savings to domestic rather than foreign households.

5.2 Effects of a Redistributive Shock to Dividend Incomes

In this simulation we assume that dividends account for 20% of initial steady state income. Figure 7 shows the effects of a 10 percentage point increase in this share. Dividend income, which accrues exclusively to top earners, increases by exactly 10 percent of GDP, while the labour incomes of top and bottom earners decrease by 1 and 9 percent of GDP. The consumption of top earners jumps by 12% on impact, and then slowly decreases. The consumption of bottom earners drops by 10% on impact, and then gradually increases.

The large increase in the share of dividend incomes leads to an increase in the price of tradable assets equal to 240 percent of GDP. This time the logic of preferences for wealth works in the opposite direction to the previous subsection. The immediate increase in top earners' wealth far exceeds their desired wealth increase following the positive income shock. They therefore dissave to consume part of their additional wealth. The real-world counterpart is of course stock-price- or house-price-driven consumption booms. Top earners therefore need to borrow since this is the only way they can increase their consumption. As domestic bottom earners do not wish to lend on the required scale, top earners borrow significantly from foreigners. As a result, the domestic economy immediately starts to run a current account deficit equal to 1.60% of GDP, which gradually declines over time as top earners decumulate wealth. After the first 5 years, the country has a negative net foreign asset position of almost 8% of GDP.

In this simulation interest rates increase by 10 basis points on impact. *Ceteris paribus* this decreases the price of the tradable asset, but unlike in the previous section this indirect effect is dominated in size by the direct effect of greater dividend income accruing to shares. The indirect

¹³Note to the discussant: The graph of Financial Assets τ / GDP is incorrect (in both figures). It should equal the sum of the value of the Lucas tree and the value of the debt. We will fix this in future versions.

effect therefore does not affect the amount of borrowing significantly.

The lessons we learn from this simulation are as follows: First, increases in inequality that affect primarily incomes derived from tradable assets, primarily dividend and interest incomes that accrue to top earners, lead to an increase in actual wealth holdings by top earners that far exceeds the more modest increase in desired wealth triggered by higher incomes. They therefore borrow domestically, but they also import savings, the counterpart of which is a current account deficit. Second, for countries that have large asset markets, these current account effects will tend to be stronger, because the wealth revaluation effects become even stronger.

6 Conclusion

This paper first makes an empirical case that increases in income inequality tend to lead to increases in current account deficits in a broad cross-section of countries, but that there are important outliers to this rule, most notably that have been pursuing an export-led rather than finance-led growth strategy. Our stylized facts and cross-country econometric evidence suggest that the magnitude of the empirical effect is large, to the point that for the United Kingdom higher income inequality may be able to approximately explain the entire current account deterioration experienced between the late 1970s and 2007.

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 (top earners) and the majority (bottom earners). When bottom earners' income share declines at the expense of top earners, who have a much higher marginal propensity to save, as they do in the data, top earners respond by not only increasing their consumption, but also their desired wealth holdings.

The critical question for current accounts is whether top earners' actual wealth holdings increase by more or less than their desired wealth holdings as a result of the positive shock to their incomes. When the shock primarily increases incomes derived from tradable assets, such as dividend incomes, actual wealth holdings increase by far more than desired wealth holdings, so that top earners borrow both domestically and abroad, and the country runs a current account deficit. When domestic credit, stock and real estate markets are large, these deficits become larger. When the shock primarily increases incomes not derived from tradable assets, such as labour incomes, actual wealth holdings increase by far less than desired wealth holdings, top earners lend both domestically and abroad, and the country runs a current account surplus. When domestic credit, stock and real estate markets are small, these surpluses become larger. These insights allow us to shed some very useful light on the pattern of international current account imbalances.

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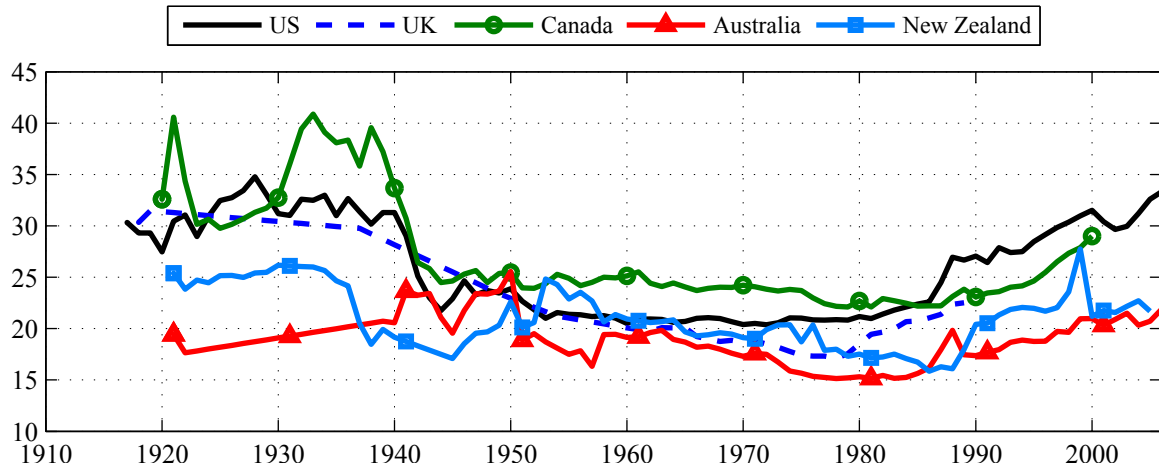
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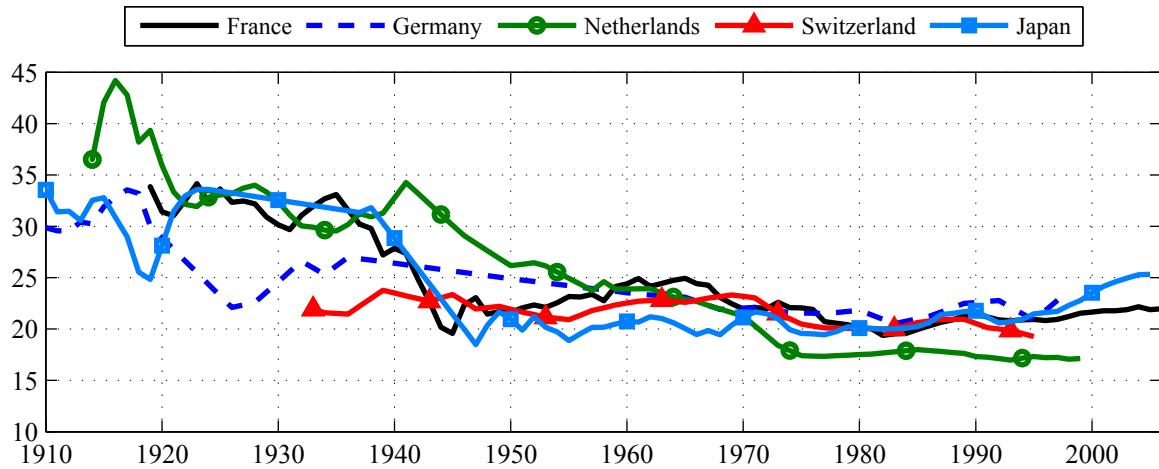
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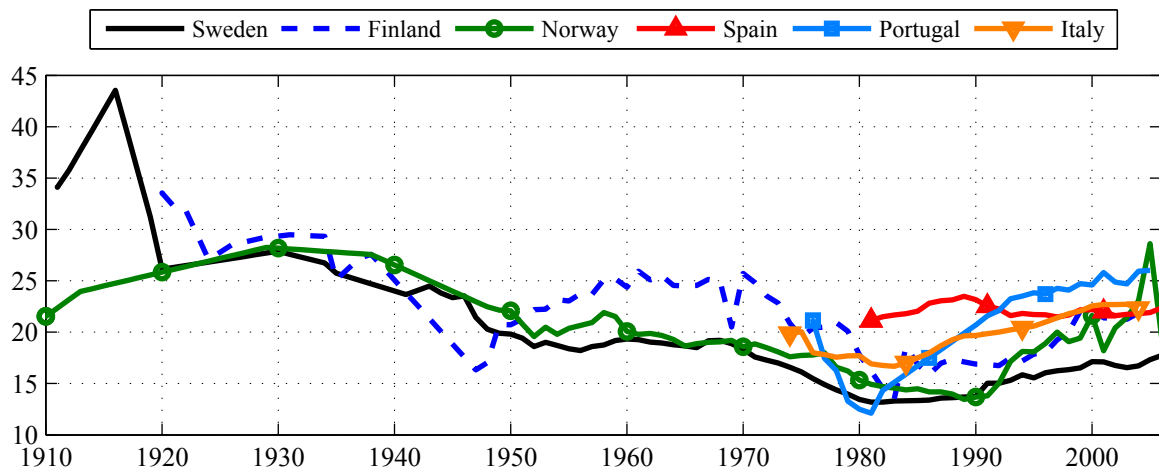
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(a) Anglo-Saxon Countries (U-shaped)

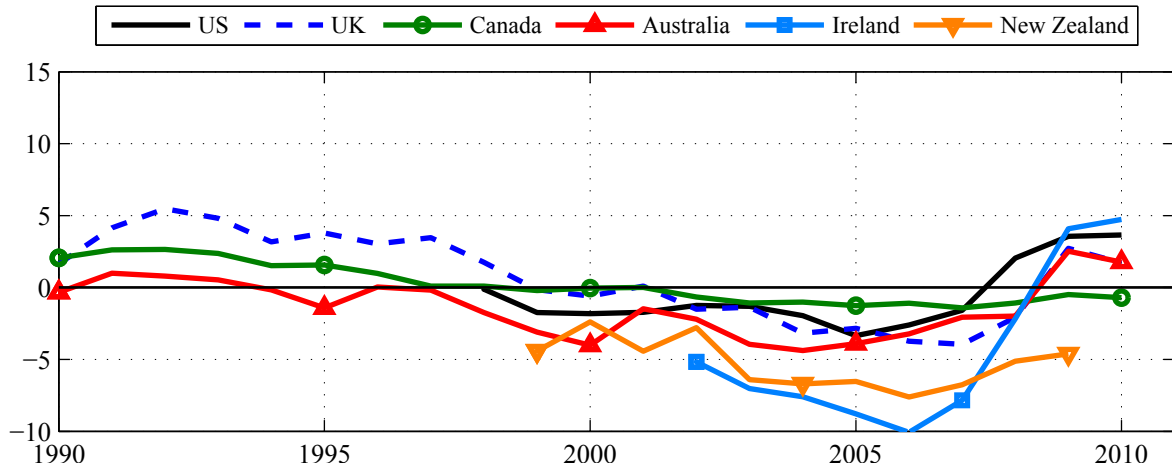


(b) Continental Europe and Japan (L-shaped)

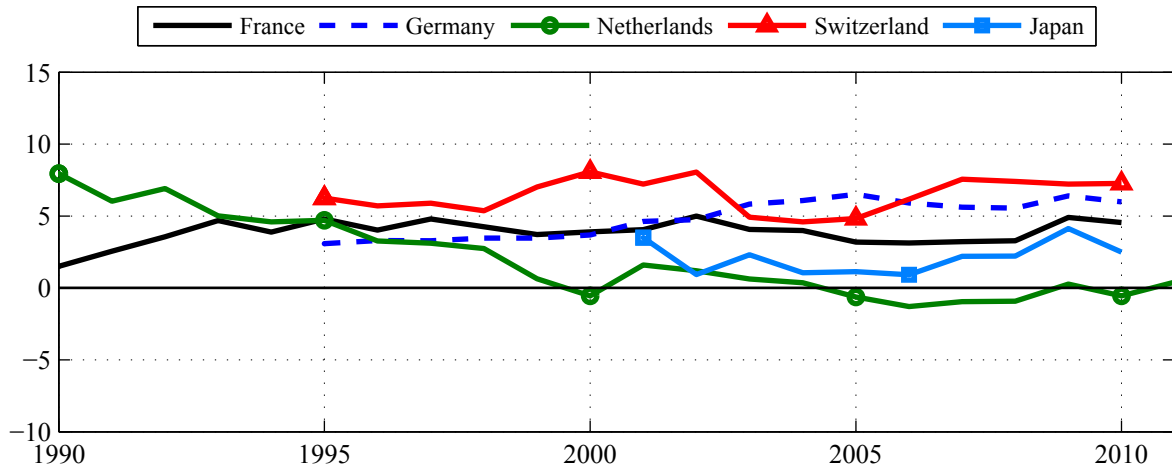


(c) Southern Europe and Nordic Countries (U/L-shaped)

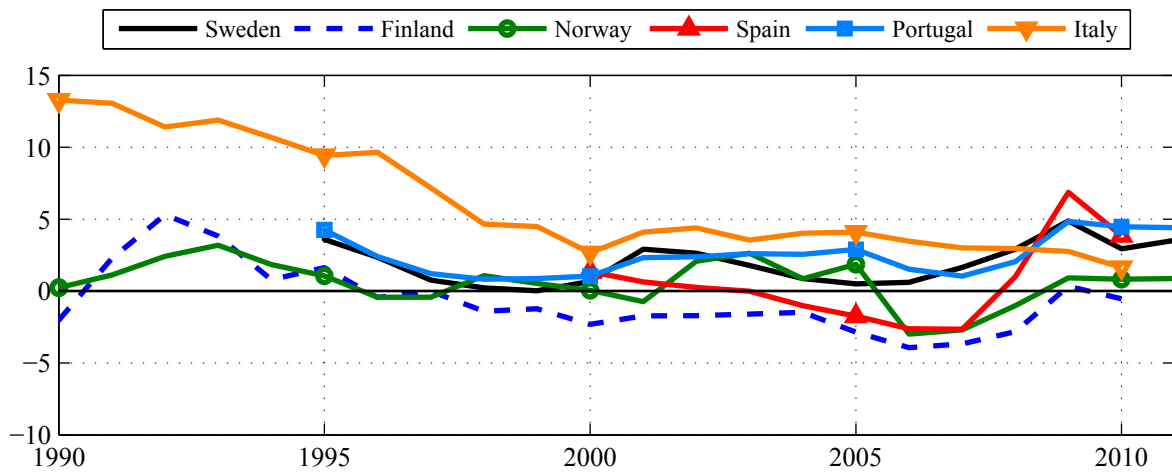
Figure 1: Income Share of Top 5 Percent by Country (in percent)



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

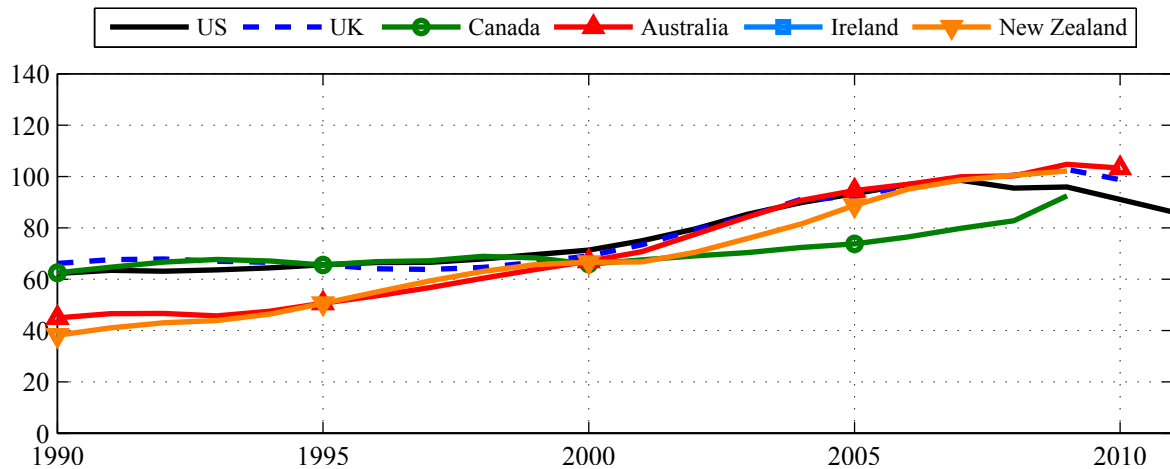


(b) Continental Europe and Japan (L-shaped)

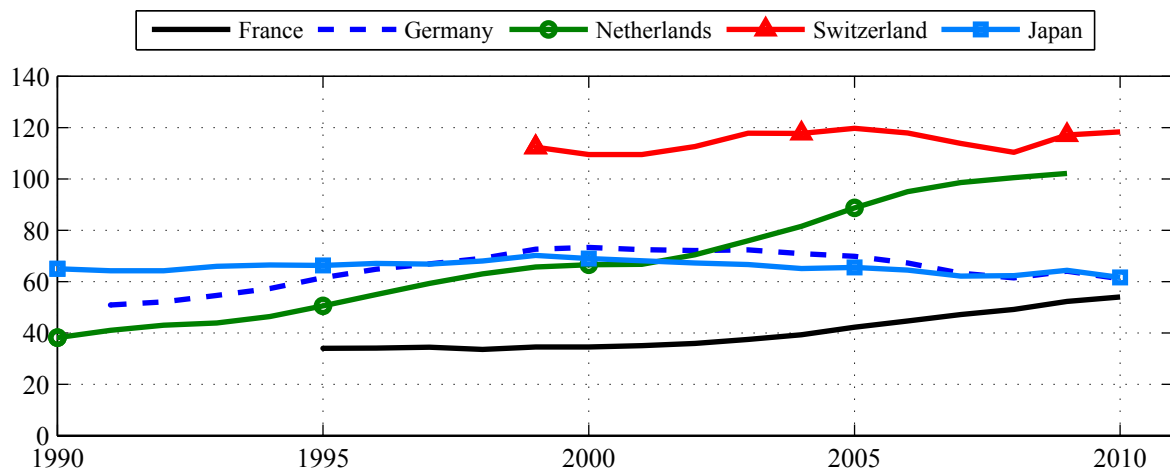


(c) Southern Europe and Nordic Countries (U/L-shaped)

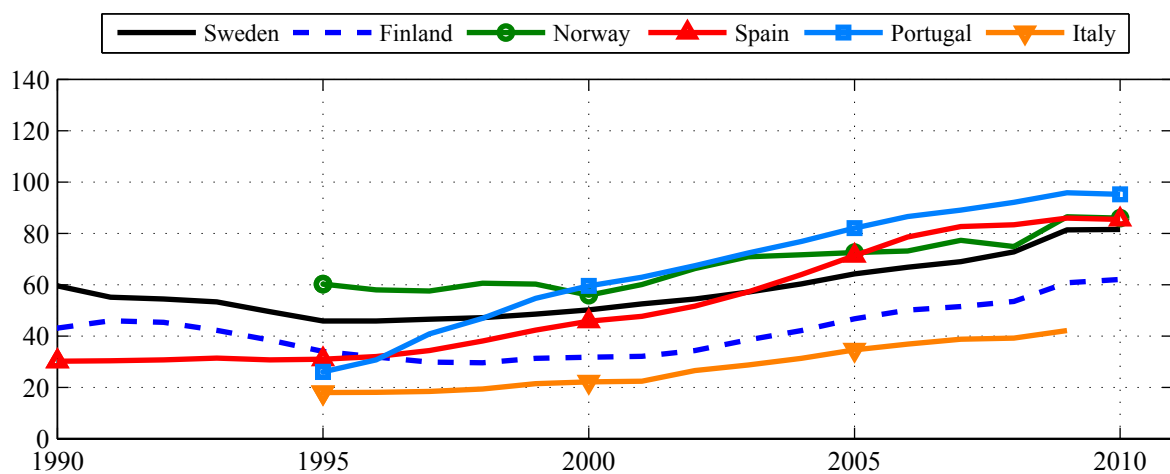
Figure 2: Net Lending/Borrowing by Households and Non-Profits (percent of GDP)



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

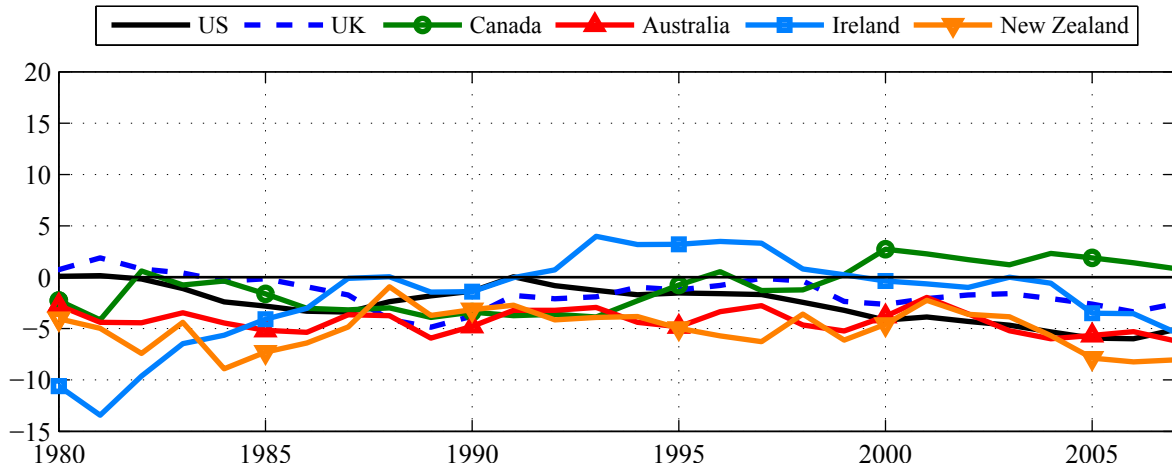


(b) Continental Europe and Japan (L-shaped)

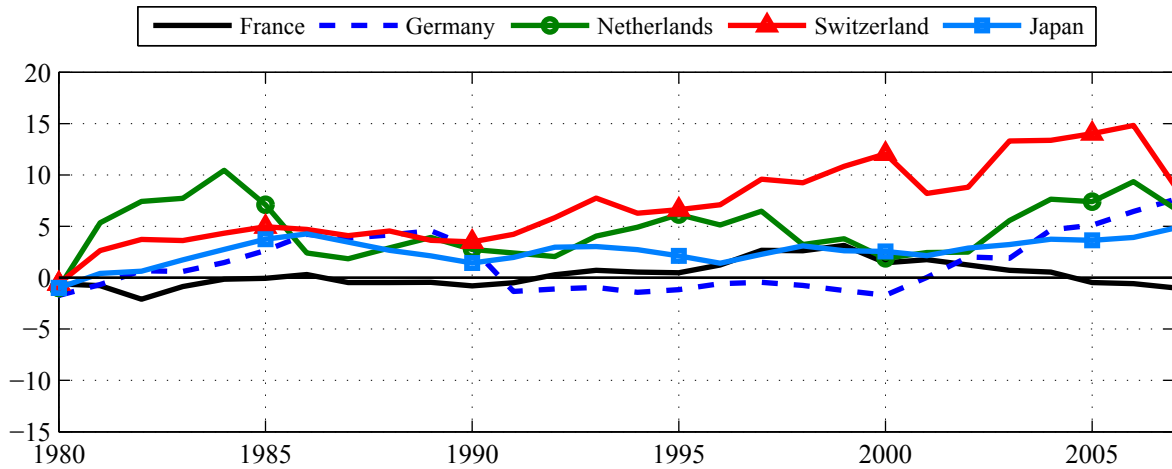


(c) Southern Europe and Nordic Countries (U/L-shaped)

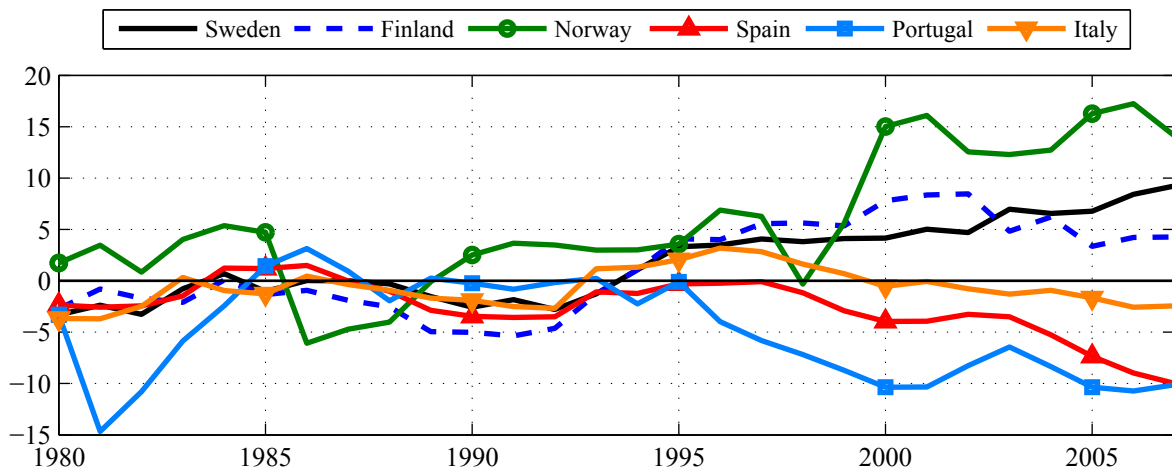
Figure 3: Household Stock of Loans (percent of GDP)



(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)

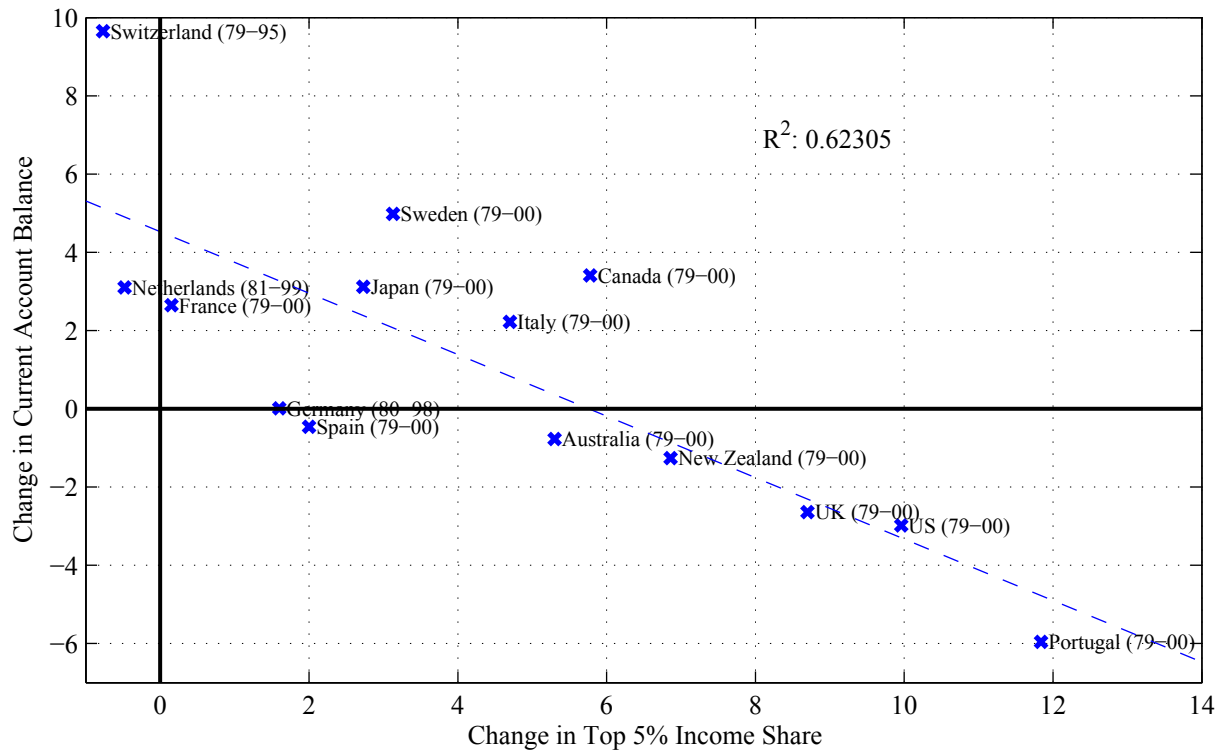


Figure 5: Changes in Current Accounts and Top Income Shares (in percent)

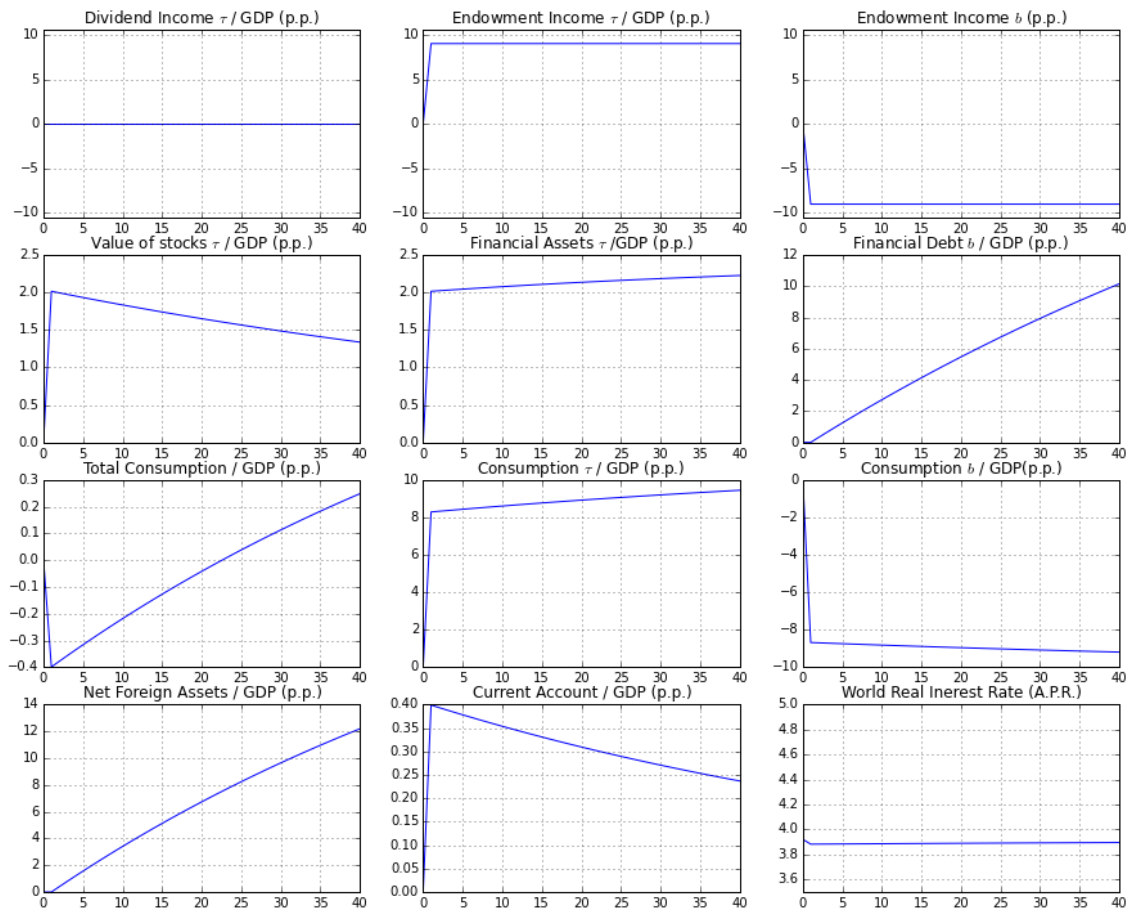


Figure 6: Effects of a 10pp Increase in the Top Labour Income Share

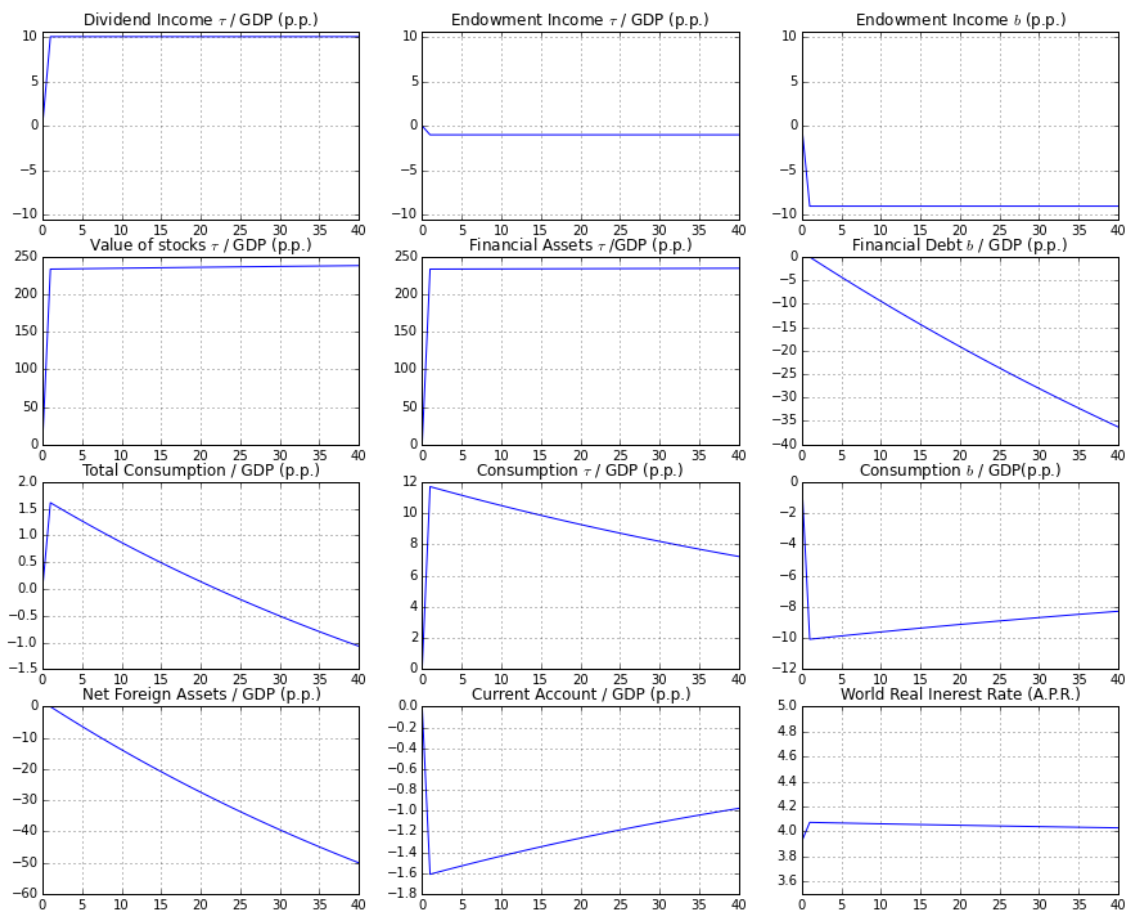


Figure 7: Effects of a 10pp Increase in the Top Dividend Income Share

Table 1. Current Account Regressions: EBA Specification augmented with Top Income Shares**Sample: OECD Countries****Dependant Variable: Current Account-to-GDP (OECD Countries)**

Income Share Top 10%			-0.127***		
			(0.001)		
Income Share Top 5%			-0.125**		
			(0.034)		
Income Share Top 1%				-0.132	
				(0.119)	
Income Share Top 0.1%					-0.320**
					(0.048)
Net Foreign Assets/GDP (lagged one period)	0.002	0.004	0.018*	0.009	0.020**
	(0.793)	(0.600)	(0.056)	(0.287)	(0.045)
(NFA/GDP+0.6)*(dum=1 if NFA/GDP<-60%), (lagged one period)	-0.001	-0.003	-0.016	-0.006	0.024
	(0.948)	(0.850)	(0.424)	(0.751)	(0.528)
Dummy=1 if country is a financial center	0.044***	0.033***	0.025**	0.030**	0.024**
	(0.000)	(0.004)	(0.036)	(0.012)	(0.047)
Sample demeaned [own PPP GDP per working population(15-64)/average of US/Japan/Germany - 1], (lagged one period)	-0.109***	-0.107***	-0.150***	-0.135***	-0.138***
	(0.007)	(0.010)	(0.000)	(0.001)	(0.001)
Sample demeaned [own PPP GDP per working population(15-64)/average of US/Japan/Germany - 1]*(1- Capital Control Index),(lagged one period)	0.157***	0.178***	0.191***	0.188***	0.186***
	(0.001)	(0.000)	(0.000)	(0.000)	(0.000)
Oil & Gas trade balance (relative to World average, 5 yr MA)*(dum=1 if >0%), WITS	0.602***	0.463***	0.529***	0.515***	0.459***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.000)
Dependency Ratio (relative to World average)	0.050	0.111**	0.018	0.021	-0.017
	(0.338)	(0.044)	(0.745)	(0.693)	(0.749)
Population Growth (relative to World average)	-0.497	-0.329	-0.453	-0.431	-0.542
	(0.343)	(0.527)	(0.417)	(0.414)	(0.358)
Aging Speed (relative to World average)	0.232***	0.256***	0.226***	0.203***	0.174***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Expected GDP growth of medium-term(5 years out) relative to World average, WEO	-0.682***	-0.647***	-0.792***	-0.783***	-0.850***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Public Health Spending/GDP (relative to World average) (lagged one period)	0.099	0.094	0.117	0.062	0.405*
	(0.671)	(0.683)	(0.617)	(0.790)	(0.082)
Demeaned VOX*(1- Capital Control Index) (lagged one period)	0.033*	0.032	0.033	0.033*	0.003
	(0.089)	(0.102)	(0.110)	(0.099)	(0.885)
Demeaned VOX*(1- Capital Control Index)*(currency's share in world reserves stock) (lagged one period)	-0.030	-0.002	-0.046	-0.019	0.030
	(0.664)	(0.979)	(0.486)	(0.770)	(0.644)
Share of the country's currency held as FX reserve by central banks worldwide	-0.057***	-0.049***	-0.045***	-0.053***	-0.054***
	(0.000)	(0.001)	(0.002)	(0.000)	(0.000)
Output Gap (relative to World average)	-0.208***	-0.207***	-0.158**	-0.190**	-0.188**
	(0.004)	(0.006)	(0.048)	(0.013)	(0.034)
Commodity Terms of Trade index deviation from trend, multiplied by openness	0.284***	0.353***	0.347***	0.350***	0.386***
	(0.000)	(0.000)	(0.000)	(0.000)	(0.000)
Safer Institutional/Political Environment Index (rel to World average), ICRG	-0.155***	-0.109***	-0.120***	-0.122***	-0.100***
	(0.000)	(0.001)	(0.000)	(0.000)	(0.003)
Private credit/GDP (rel to World average)	-0.035***	-0.040***	-0.033***	-0.033***	-0.022**
	(0.000)	(0.000)	(0.001)	(0.000)	(0.042)
Cyclically Adjusted Fiscal Balance (relative to World average)(instrumented)	0.604***	0.365**	0.490***	0.475***	0.496***
	(0.000)	(0.019)	(0.001)	(0.001)	(0.002)
Capital Control*(Changes in Reserves)/GDP, (relative to World average) instrumented	-0.129	0.309	0.620	0.503	1.268*
	(0.843)	(0.642)	(0.380)	(0.462)	(0.085)
Observation	463	417	396	416	336
Countries	19	19	18	19	16
R-Square	0.681	0.694	0.721	0.682	0.740
Root MSE	0.028	0.026	0.025	0.027	0.025

*** p<0.01, ** p<0.05, * p<0.1

Table 2. Current Account Regressions: Top Income Shares interacted with Private Credit to GDP**Sample: OECD Countries****Dependant Variable: Current Account-to-GDP (OECD Countries)**

Share Top 10%	-0.123*** (0.002)			
Share Top 10% * Private Credit / GDP	-0.114*** (0.000)			
Share Top 5%		-0.125** (0.034)		
Share Top 5% * Private Credit / GDP		-0.144*** (0.001)		
Share Top 1%			-0.132 (0.119)	
Share Top 1% * Private Credit / GDP			-0.333*** (0.001)	
Share Top 0.1%				-0.310* (0.057)
Share Top 0.1% * Private Credit / GDP				-0.665** (0.043)
Net Foreign Assets/GDP (lagged one period)	0.006 (0.480)	0.018* (0.061)	0.009 (0.289)	0.022** (0.029)
(NFA/GDP+0.6)*(dum=1 if NFA/GDP<-60%), (lagged one period)	-0.006 (0.761)	-0.016 (0.422)	-0.006 (0.740)	0.027 (0.481)
Dummy=1 if country is a financial center	0.032*** (0.007)	0.025** (0.044)	0.029** (0.015)	0.025** (0.042)
Sample demeaned [own PPP GDP per working population(15-64)/average of US/Japan/Germany - 1], (lagged one period)	-0.108*** (0.009)	-0.149*** (0.000)	-0.134*** (0.001)	-0.131*** (0.003)
Sample demeaned [own PPP GDP per working population(15-64)/average of US/Japan/Germany - 1]*(1- Capital Control Index),(lagged one period)	0.178*** (0.000)	0.189*** (0.000)	0.187*** (0.000)	0.180*** (0.000)
Oil & Gas trade balance (relative to World average, 5 yr MA)*(dum=1 if >0%), WITS	0.457*** (0.001)	0.530*** (0.000)	0.515*** (0.000)	0.463*** (0.000)
Dependency Ratio (relative to World average)	0.118** (0.034)	0.020 (0.714)	0.022 (0.678)	-0.017 (0.755)
Population Growth (relative to World average)	-0.342 (0.511)	-0.427 (0.451)	-0.418 (0.431)	-0.610 (0.295)
Aging Speed (relative to World average)	0.252*** (0.000)	0.226*** (0.000)	0.203*** (0.000)	0.169*** (0.000)
Expected GDP growth of medium-term(5 years out) relative to World average, WEO	-0.635*** (0.001)	-0.792*** (0.000)	-0.784*** (0.000)	-0.759*** (0.000)
Public Health Spending/GDP (relative to World average) (lagged one period)	0.085 (0.713)	0.119 (0.610)	0.064 (0.782)	0.363 (0.120)
Demeaned VOX*(1- Capital Control Index) (lagged one period)	0.031 (0.122)	0.033 (0.108)	0.033* (0.098)	0.011 (0.608)
Demeaned VOX*(1- Capital Control Index)*(currency's share in world reserves stock) (lagged one period)	0.004 (0.951)	-0.045 (0.492)	-0.018 (0.781)	0.023 (0.718)
Share of the country's currency held as FX reserve by central banks worldwide	-0.050*** (0.001)	-0.046*** (0.002)	-0.053*** (0.000)	-0.057*** (0.000)
Output Gap (relative to World average)	-0.211*** (0.005)	-0.160** (0.045)	-0.191** (0.013)	-0.214** (0.015)
Commodity Terms of Trade index deviation from trend, multiplied by openness	0.353*** (0.000)	0.347*** (0.000)	0.351*** (0.000)	0.403*** (0.000)
Safer Institutional/Political Environment Index (rel to World average), ICRG	-0.106*** (0.001)	-0.120*** (0.000)	-0.122*** (0.000)	-0.104*** (0.002)
Private credit/GDP (rel to World average)	-0.074* (0.055)	-0.043 (0.328)	-0.038 (0.185)	-0.016 (0.423)
Cyclically Adjusted Fiscal Balance (relative to World average)(instrumented)	0.365** (0.019)	0.491*** (0.001)	0.476*** (0.001)	0.420** (0.010)
Capital Control*(Changes in Reserves)/GDP, (relative to World average) instrumented	0.329 (0.620)	0.629 (0.373)	0.512 (0.457)	0.701 (0.350)
Observation	417	396	416	336
Countries	19	18	19	16
R-Square	0.694	0.721	0.682	0.740

*** p<0.01, ** p<0.05, * p<0.1