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Financialization, asset prices, and the functional distribution of income: A long-run cross-country analysis

DRAFT VERSION

1. Introduction:

Economists have neglected for a long time changes in the functional distribution of income. In fact, one of the stylized facts of neoclassical growth theory is that factor shares are relatively constant in the long-run, with some minor fluctuations that occur throughout the business cylce (Jones, 2002). Piketty's magnum opus "Capital in the 21st century" brought the topic back onto the macroeconomic research agenda (Piketty, 2014). His data shows that that the capital share of GDP has exhibited a U-shaped pattern over the 20th century with high values in the beginning and high values at the end century. The main theme of Piketty's book is that we can expect a higher value for the capital share going forward. Most importantly, it is the middle of the 20th century when the capital share was very low (and the labor share was very high) that seems to be the aberration from the norm. Three main shocks, the two World Wars and the Great Depression, led to an enormous destruction of capital around the world. The capital to income ratio was depressed for several decades, which also led to a lower capital share of income. Over the last three decades, however, both values have recovered from their 20th century low and this trend is expected to continue for the foreseeable future (Piketty, 2014). Piketty (2014), and more recently Rognlie (2015) as well as La Cava (2016), show the specatcular increase in real house prices over the last decades has led to a much higher capital to income ratio. This also came hand in hand with a higher capital share of income.

In what follows, we further explore the link between asset prices and the capital share. Combining two novel macroeconomic history datasets, the macroeconomic database by Jorda, Schularick, and Taylor (2016) and the Bengtsson-Waldenström (2015) capital share dabase, gives us a rich set of panel data for 17 advanced economies (see table 1) that goes back until the end of the 19th century for some of the countries in our study. The dataset is more comprehensive than Piketty's (2014) original analysis, which only includes eight advanced economies.

First, we find the same U-shaped pattern for the capital share. This result holds both for the gross as well as the net labor share (factoring out depreciation). As depreciation is not an income to any factor of production, focusing on net shares might be more relevant if one is conerned about distributional issues. Second, asset price booms have the expected effect on movements in the capital share. Changes in stock prices seem to be more important than changes in house prices. However, the effect of housing might be more indirect via credit expansions. Many advanced economies have seen spectacular increases in their mortgage to GDP ratio in rencet decades. High leverage is supported by large increases in real house prices.

We find that both the nominal interest rate and credit growth is positively correlated with the capital share. Finally, we confirm some results that have been found in the academic literature. A high pressure economy, as measured by real GDP growth and the output gap, is positively correlated with the capital share. This can be explained by the fact that that markups are procyclical. Last but not least, government spending is negatively correlated with the capital share. This is not very surprising as the government sector does not report any profits.

The first part of this paper comprises of a literature review of the most important empirical studies on changes in the functional distribution of income. The second part describes some key long-run macroeconomic trends in the countries under considerations for the time period of our study. Furthermore, we also use a comparative approach where we point out similarities between the "socialist" Nordic countries and the "capitalist" Anglo-Saxon economies. The main emperical strategy used in this paper is the estimation of a Panel-VAR model for our key variables of interest: Monetary variables, credit growth, asset prices, GDP, and the functional distribution of income. All of these variables are treated as being endogenousely determined by and "within" the macroeconomy. We follow closely the approach used by Goodhart and Hofman (2008) who use a very similar model to study the multidirectional link between house prices and monetary variables. The advantage of the Panel-VAR approach is that it allows us to test for Granger causality for the key variables of interest mentioned above. The Panel-VAR approach also allows us to estimate a set of impulse response function. Last but not least, we use a Panel-OLS model to examine the main macroeconomic variables that have been driving flucutations in the functional distribution of income. This second apporach allows us to introduce more control variables in our specification. A drawback is that both models impose pooling restrictions across countries. We therefore disregard cross-country differences in addition to disregarding differences across time periods and different macroeconomic regimes. The first problem is more or less unavoidable because of the nature of our data. With annual data for all macroeconomic variables, estimating the model for each country seperately will not give us sufficient degrees of freedom, which would decrease the efficiency and the statistical power of the analysis. The second problem can be overcome by estimating the panel model seperately for different time periods.

Our analysis indeed suggests that there is a substantial positive statistical relationship between asset prices, especially stocks, and the functional distribution of income. In terms of Granger causality, we find that stock prices do indeed cause changes in the capital share of income. In terms of house prices, we cannot detect the anticipated positive effect between housing and the capital share of income in our Panel-VAR model.

The results from our Panel-OLS analysis also suggest a very strong positive statistical relationship between stock prices and the capital share of income. Furthermore, we also find weak evidence for a relationship between house prices and the capital share. The result seems to be stronger when we use an alternative measure for the labor share as suggested by the OECD (ILO 2015), namely total employee compensation by activity as share of gross value added, instead of using the gross capital share of GDP from the Bengtsson-Waldenström database (2015).

2. Literature review:

Economists have simply assumed for a very long time that the functional distribution of income is relatively stable in the long-run, with only minor fluctuations throughout the business cycle. Standard neoclasscial growth models usually assume that the labor share is roughly two third of output while the remaining one third is capital income (Jones, 2002). Piketty's (2014) contribution was to show that the capital to income ratio has exhibited a U-shaped pattern for all major economies with high values in the beginning as well as at the end of the 20th century. The working hypothesis is that the three major global shocks, the two World Wars and the Great Depression, have led to an enourmous destruction of wealth from which it took several decades to recover. Similarly, the capital share has followed the same U-shaped relationship over the course of the 20th century. While Piketty's (2014) analysis has focused on a time span that covers more than two centuries of data for eight advanced economies, most empirical studies have focused on more recent data. Karabarbounis and Neiman (2013), for example, find a statistically significant decline in the labor share in 37 out of a sample of 59 countries during the period from 1975 to 2012. Furthermore, the same authors show that in a cross-country analysis that 22 out of the 24 countries that experienced a decline in gross labor shares also experienced a decline in net labor shares at the same time. The correlation between the two is thus extremely high (Karabarbounis and Neiman, 2014).

There are a number of potential economic explanations, which have been offered to explain the phenomenon of the falling labor share of income. Many explanations tend to focus in one way or the other on the bargaining power of labor and monopoly power. Fichtenbaum (2011), for example, suggests that the decline of labor unions is to blame, as it would weaken the bargaining power of workers. While this explanation might seem reasonable for the U.S., other countries have not experienced an erosion of labor unions, but the labor share decreased regardless. Stockhammer (2013), on the other hand, offers a more global explanation. According to this study, global deregulation and liberalization of financial markets has led to a decline in the bargaining power of labor as firms face a larger number of investment opportunities, both domestic and abroad. This increased flexibility would weaken the relative strength of workers and increase markups. Grenestam and Probst (2012) have estimated markups for different U.S. industries and have confirmed an increase over the last decades, which could explain a significant part of the fall in the labor share. This result was more recently corroborated by Barkai (2016) who also finds an increase in markups and financial profits for the private sector in the U.S. Autor et al. (2017) find that a lot of industries are increasingly dominated by so-called superstar firms, which tend to be highly profitable and low labor share companies. Accordingly, it is the rise in industry concentration that led to the increase in capital income and monopoly rents. Koh et al. (2014) emphasize that the monopoly rents are largely stemming from IPP (intellectual property rights). The decline in the labor share can thus largely be explained by the rise of IPP, such as patents, and the associated monopoly power that stems from it.

Alternatively, non-neutral technological change can also account for a change in the factor share of income. The result, however, is relatively specific to the underlying production function as emphasized by Hicks (1932). As capital-biased technological change reduces the cost of one unit of effective capital relative to one unit of effective labor, firms face an increased incentive to switch to a more capital-intensive method of production. Whether the capital share will rise as a result, however, is dependent on the elasticity of substitution, i.e. to what degree labor can be substituted for capital and vice-versa. Only if the elasticity is larger than one, that is when capital and labor are highly substitutable, will the capital share actually increase. In the Cobb-Douglas case where the elasticity is equal to unity non-neutral technological change does not alter the factor shares of income in the long-run. Determining the elasticity of substitution is thus ultimately a matter of empirics. Furthermore, to what extent capital and labor are substitutable surely depends on the time horizon under consideration, that is, the short-run elasticity will be lower than the long-run elasticity. There is also some conflicting evidence on the micro and macro level (Acemoglu and Robinson, 2015). Jones (2003) argues that the long-run production function is likely to be Cobb-Douglas. Karabarbournis and Neiman (2013), on the other hand, estimate that the elasticity of substitution between capital and labor is likely to be about 1.25. Given this parameter value, they find that a large decline in the labor share can be accounted for by the relative decrease in the price of investment (capital goods) in recent decades. This would be in line with Piketty's (2014) estimate that, in general, capital accumulation does not produce a sufficient decline in interest rates to keep the capital share constant.

More recently, Grossman et al. (2017) have disputed the assumption that the elasticity of substitution is larger than one. They construct a neoclassical growth model with endogenous human capital accumulation and capital-skill complementary. The authors emphasize that the global productivity slowdown can explain a substantial fraction of the decline in the labor share worldwide. The secular stagnation outcome, a low growth and low real interest rate regime, leads to an increase in the human capital stock. This, in turn, raises the capital share as skills and capital are assumed to be complementary in the model.

Rognlie (2015), on the other hand, emphasizes that the rise in the capital share can to a large extent be explained by trends in the housing market. House prices have appreciated considerably in all advanced economies since the 1960s. This effect has been particularly strong in large metropolitan areas as a result of increasing agglomeration effects while misguided housing policies kept supply artificially low. As a consequence, house owners are able to extract extremely high rents from their underlying assets. This theory is also backed up by La Cava (2016) who finds that housing is the most important driver of the capital share in the U.S. in recent decades. Expenditures on housing services as a share of GDP increased from 4% in the 1960s to 6% nowadays. Interestingly, most of the change is the result of imputed rents, which begs the question whether the rising capital share might simply be a statistical illusion resulting from the methodology of computing imputed rents.

There are, to the best of our knowledge, very few existing studies that have touched upon the question whether asset price growth might exert downward pressure on the labor share of GDP. According to economic theory, the relationship between asset prices and the functional distribution of income is ambiguous, as the effect depends on the elasticity of substitution between capital and labor (Piketty, 2014). Higher asset prices can theoretically depress interest rates by a sufficient amount so that the capital share actually falls. It is thus ultimately a matter of empirics to determine during which time periods an increase in the capital to income ratio led to a rise in the capital share.

The first-round effect of an increase in asset prices is simply an associated increase in capital gains. This would only affect the functional distribution of income if some of these gains are eventually realized. Roine and Waldenström (2012) show that in the case of Sweden realized capital gains have indeed played an important contribution in the role of rising inequality over the last few decades. According to their estimates, realized capital gains have increased from about 1% of total national income in the 1980s to more than 4% in the late 2000s. Moreover, the distributional impact of capital gains appears to be a phenomenon that is more or less exclusively affecting incomes at the very top of the distribution. While Roine and Waldenström (2012) rule out real estate as a transmission mechanism, they point towards the Swedish stock market, which experienced a booming period with annual real gains of 13% and 16% in the 1980s and 1990s, respectively (compare that to more modest growth rates of 3% and 6%, respectively, for the New York stock exchange). There is also a secondary effect, which is that higher asset price valuations would ultimately support higher income streams down the line. One might expect this effect to kick in with a time lag of up to several quarters or even years. In the case of stocks, higher valuations can lead to larger dividend payouts. In the case of real estate, higher prices might ultimately support higher rents, or higher imputed rents in the case of owner-occupied housing, as suggested by LaCava (2016).

High stock prices also affect investment and consumption decisions. According to Tobin (1976), high stock market valuations provide firms an incentive to invest, a theory also known as "Tobin's Q" (the ratio between a physical asset's market value and its replacement cost). A high marginal q would imply that investment activities are very attractive, i.e. have a high return. Finally, high asset prices, both stocks as well as real estate, also affect the savings and consumption decisions by households, the so-called wealth effect (Mishkin, 2007a). As rising asset prices affect the investment decisions of firms and the consumption pattern of households, this might also alter the balance between capital and labor income in the economy. A priori, investments tend to be more capital intensive whereas household consumption might be more labor-intensive, especially if it is consumption of services.

Last but not least, we also need to address the issue of reverse causality. More recently, Greenwald et al. (2014) have estimated that a factor shift shock from labor income to capital income can explain increases in stock prices. More specifically, such a factor shock can explain a significant portion of the aforementioned rise in the U.S. stock market. We thus also need to address in this paper the issue that causality might also run from changes in factor shares to movements in asset markets. The Panel-VAR model approach allows us to test for Granger causality. And indeed our analyisis corroborates the bidirectional relationship between asset prices and factor shares.

3. Data and methodology:

This paper uses long-run macroeconomic history data to estimate a relationship between rising asset prices and the functional distribution of income. We combine two macroeconomic databases: The Macrohistory database by Jorda et al. (2016a) as well as the Bengtsson-Waldenström (2015) capital share database. This gives us a unique macroeconomic panel dataset comprising 17 advanced economies with time series data on an annual basis going back to 1875 for some of the countries in our panel.

There are some methodological issues when it comes to the measurement of the actual capital share, most notably when it comes to depreciation of the capital stock and self-employment, which are both relatively hard to quantify. Bengtsson and Waldenström (2015) make an adjustment for self-employment. The gross capital share of national income is thus simply defined as 100 minus the adjusted wage share, where the wage share is adjusted for the imputed labor income of the self-employed. This is the measure we will mostly use for our analysis. The database also includes the net capital share, which is defined as net capital income over net GDP. This alternative series has the advantage of being adjusted for depreciation. However, depreciation is being imputed and thus remains fairly constant, at least in the short-run. The correlation between changes in the gross capital share and changes in the net capital share is extremely close to one, meaning that the second series does not contain any additional useful information for the purpose of our statistical analysis. However, as a robustness check, we will compare the Bengtsson-Waldenström database with a dataset from the OECD, which contains data for total employee compensation as a share of gross value added for our 17 advanced economies from 1970 onwards.

One advantage of our panel data is that the the time series is relatively long and even stretches back to the end of the 19th century, which allows us to analyze changes in the functional distribution of income over a very long time horizon and across different macroeconomic regimes, starting with the gold-standard in the late 19th and early 20th century, followed by post-war Keynesianism, which was subsequently replaced with the neo-liberal regime and modern Central Banking. A drawback of our approach, however, is that we only have annual data and that our cross-section is relatively small since it comprises only 17 advanced economies. We estimate a Panel-VAR model for our main macroeconomic variables of interest (money, credit, asset prices, interest rate, GDP, and the functional distribution of income), which are determined endogenously within and by the macroeconomy. This approach also allows us to test for Granger causality and estimate impulse response functions. As a second approach, we also estimate a normal Panel-OLS, which allows us to include more macroeconomic variables as potential controls. We try to address the issue of reverse causality between the capital share and asset price inflation by including lagged variables of the latter. We also control for country fixed-effects to control for idiosyncratic (country-specific) shocks. However, we choose to not include time fixed-effects because of the nature of our data. With a small cross-section and long time series including time fixed-effects would drastically reduce the efficiency and power of our estimations.

4. Long-run macroeconomic trends and descriptive statistics:

4.1 The capital share, the capital stock, and interest rates

Before digging deeper into the main statistical analysis of the paper, we elaborate on the main macroeconomics trends using descriptive statistics for our set of 17 advanced economies for the time period under consideration.

Figure 1 depicts the average gross capital share of income as well as average net capital share for the 17 countries in question since 1875. We find the U-shaped pattern that has been previously found by Piketty with high values for the gross share above 35% of GDP both in the beginning as well as in the end of the 20th century. While there has been a more than six percentage point increase over the last few decades in favor of capital income, the long-run data shows that it is the post World War II period that was the aberration from the norm. According to Piketty (2014), it is the three major global shocks, two World Wars as well as the Great Depression, which led to an enormous amount of capital destruction all over the world. Consequently, it took several decades until capital-income ratios recovered from an all-time low in the 1950s. This process of capital deepening, however, has not led to a substantial decline in interest rates, thus explaining the gradual increase in the capital share over time. In terms of the following equation, the increase in the capital stock (K) did not depress interest rates (r) as to lead to a reduction in the capital share (r*K), which increased instead.

$$(1) \quad GDP = r * K + w * L$$

Figure 1 also displays the average net capital share over time across our panel. While the net share has also seen a significant rise in recent decades, it has not been as dramatic as the rise in the gross share. This implies that the economy-wide depreciation rate has also increased over time.

Figure 2 displays the average nominal short-term interest rate and average nominal long-term interest rate over the course of the 20th century. We can see that short-term interest rates have indeed reached an all-time low in recent years as many Central Banks in advanced economies have pushed their key interest rate down against the zero-lower bound. Long-term interest rates, on the other hand, are not substantially lower than during the end of the 19th century, the period of the classical gold standard. Indeed, it is again the post World War II period that stands out with nominal interest rates reaching an all-time high of more than 12% in the early 1980s while declining sharply in the decades thereafter. Of course, most of this can be attributed to the Fisher effect, meaning that nominal interest rates (i) almost increase one to one with inflation (π) in the medium to long-run (Fisher, 1930).

$$(2) \quad r = i - \pi$$

In standard neoclassical growth models, the real interest rate is solely determined by the marginal productivity of capital. Real rates are pinned down by structural factors only (the supply-side) and thus completely independent of nominal variables. This is the so-called long-run neutrality of money (Bernanke and Mihov, 1998). In practice, however, real interest rates show substantial variations over time because they also tend to fluctuate with the business cycle and the output gap (Laubach and Williams, 2016).

Figure 3 shows the average investment rate over time. There has been a dramatic uptick in the post World War II period as the investment share of GDP increased by about 10 percentage points from 15% to 25% of GDP. The two World Wars led to an enormous destruction of capital, especially in Europe. A higher investment rate was thus a necessity to replenish the economy's capital stock. Recent decades, however, have seen a marked decline in the gross investment rate. Furthermore, net investment declined even further as a result of higher economy-wide depreciation. This decline in the investment rate might have been one of the contributors of the recent global productivity slowdown, which started before the outset of the Global Financial Crisis.

Figure 4 displays the average economy-wide depreciation as share of GDP based on 14 countries[1] in the Bengtsson-Waldenström database. One can see a marked increase in recent decades. Depreciation as a share of GDP has basically doubled since the early 1900s from about 8% to 16% of GDP. This marked increase can explain part of the decline in the gross capital share. This effect might be related to structural changes in the economy, more specifically the more intensive use of ICT (Information and communications technologies). IT equipment seems to become obsolete and outdated at a faster pace than other industrial structures (Haacker, 2010).

Data from the Penn World Tables, however, show that the average depreciation rate is not significantly higher than in the 1950s (figure 5). There seems to be quite considerable cross-country difference though as the depreciation rate in the U.S. edged up from about 4% of GDP after World War II to almost 5% of GDP in recent years whereas some other countries have even seen a decline. However, even with a constant depreciation rate the process of capital deepening implies a higher deprecation share of GDP. Figure 6 shows that the average capital stock increased from about 300% of GDP in the postwar period to about 450% nowadays. A capital-income ratio of three combined with a depreciation rate of 4% implies economy-wide depreciation of 12% of GDP, whereas a capital-income ratio of 4.5 with the same depreciation rate implies economy-wide depreciation of 18% of GDP.

Again, the U.S. seems to be somewhat of an outlier with the capital stock fluctuating around a more or less constant level of 300% of GDP over the last 60 years. The process of capital deepening thus only took place in other advanced economies, mostly Europe and Japan, during the postwar boom period, which led to rapid catch-up growth to the technological leader that has been the U.S. economy for most of the 20th century (Feenstra et al., 2015).

4.2 Increasing financialization and asset prices

One of the most dramatic shifts of the last few decades has been the marked rise in debt levels. This is true for the public sector, but even more so for the private sector. Figure 7 shows that the average debt level in my sample of 17 advanced economies increased by about 20 percentage points in the aftermath of the Global Financial Crisis. While public sector debt is at elevated levels, public debt was actually even higher in the beginning of the 20th century as a result of the Great Depression and two World Wars that had to be financed. UK public debt actually exceeded 180% and 230% in the aftermath of the World War I and World War II, respectively. In this light the current British public debt of about 80% of GDP actually looks relatively benign. Furthermore, with the spectacular decline in interest rates, the debt

[1] Belgium, France, Portugal, Switzerland are excluded.

burden for many advanced economies has actually declined in terms of interest payments due, despite the increase in the level of debt.

Somewhat more concerning is the continuous increase in private sector leverage. Figure 8 shows that loans to the private sector almost doubled, on average, from about 60% of GDP to close to 120% in the immediate aftermath of the crisis. A substantial part of this increase can be attributed to mortgage loans, which increased from a mere 20% of GDP to almost 70% of GDP in recent years. Housing and real estate in general have significantly increased in importance over the last decades.

Figure 9 shows the evolution of real house prices since 1870. Surprisingly, house prices have shown a remarkable stability for about a century until the late 1960s. Nominal house prices increased more or less in tandem with inflation rates, meaning that real house prices stayed relatively constant during that time period. There seems to be a structural break in the 1960s after which real house prices increased rapidly. They almost doubled until the late 1990s, and then increased by another 60% within just two decades. The paradox of globalization has been that location has become increasingly more important. Despite extremely high wages as well as the most expensive real estate prices in the world, it still makes sense for many ICT companies to be located in Silicon Valley because the positive externalities still seem to outweigh the negative cost. Positive spillover effects between firms, linkages between different industries (Marshall, 1890), thick labor markets, and the positive amenities associated with living in large metropolitan are the main drivers that can explain clustering and increased economic concentration (Carlsen & Leknes, 2015). According to Lord Turner (2015), the increasing importance of location-specific real estate combined with increasing financialization has created dangerous boom and bust cycles over the last couple of decades in many advanced economies. The sharp rise in real house prices has created a positive wealth effect. Rising asset prices can serve as collateral for debt-financed consumption. Vice-versa, credit booms can lead to spectacular run-ups in asset prices, sometimes far in excess of what might be justified by fundamentals.

In table 2 we test the idea that there has been structural change in the economy concerning the house market and private sector credit. We use a very simplistic approach where we simply estimate a linear trend for our three key variables of interest (real house price, the loan to GDP ratio, and the credit to GDP ratio for each country individually). We then test for structural breaks in the time series data and estimate the trend coefficient before and after the break. The results indicate that indeed in most countries a structural break occurred in the post-war period. Countries like Australia, Canada, Norway, and Sweden, for example, have seen significantly faster house price appreciation and private sector credit growth since the 1980s.

In what follows, we confirm the interaction between asset prices and credit growth. Note that both measures of credit, the mortgage to GDP ratio and total private sector credit, are highly correlated with each other, including their first differences (table 3). This is not very surprising. Mortgages nowadays make up the largest fraction of private sector credit in many advanced economies, especially Scandinavia where extremely high house prices have been supported by a high mortgage to GDP ratio.

Table 4 displays the simple correlation between the change in real house prices and the two measures of credit, the mortgage to GDP ratio and the total private sector loan to GDP ratio. Both are measured in first differences. We also include two lags as to measure the impact of past credit growth. We find a quite substantial positive correlation between current credit growth and changes in real house prices. The correlation with past credit growth is slightly lower but still positive. Our Panel-VAR analysis below provides further support for the interaction between asset prices and credit growth. This more elaborate model also allows us to test for Granger causality.

5. The socialist Nordic countries vs. the Anglo-Saxon capitalists: A comparative analysis

The Nordic model has received more and more attention in recent years, especially in the light of rising levels of inequality that have been much more pronounced in the Anglo-Saxon economies (Piketty, 2014). The Scandinavian economies have been increasingly evoked as a role model. Some of the main features include universal healthcare, free higher education, collective wage bargaining by labor unions that ensures adequate pay even for low-wage occupations, affordable and high-quality public transportation, good economic institutions and high living standards in general (Andersen et al., 2007). However, when it comes to the evolution of the housing market we do not find any evidence for Scandinavian exceptionalism. Figures 10 and 11 show real house prices for the Anglo-Saxon economies and for the Scandinavian economies, respectively. Since 1990, real house prices have tripled in Norway and more than doubled in Denmark even though the latter country displayed a marked decline in recent years. This is a result of a long-lasting economic downturn since the Global Financial Crisis. Denmark is trapped by the hard currency peg to the Euro, which implies that Danish monetary policy is de facto made in Frankfurt. Similarly, real house prices have also doubled in Sweden over the same time period. Finland is the notable exception. House price appreciations have been much more benign, but it should be noted that the country has also suffered from a decade of economic stagnation as a result of the Euro Crisis.

It is somewhat surprising that house price appreciations in the Anglo-Saxon economies have been more benign, especially in the U.S., which is the country that is normally associated with the housing bubble. As a matter of fact, in comparison with Australia, Canada, or the UK, the American "housing bubble" looks relatively harmless insofar as the other countries have experienced even more pronounced house price booms.

In terms of credit booms, it is again the Nordic economies that stand out. Surprisingly, Scandinavia has seen a much larger increase in financialization related to real estate as measured by the mortgage to GDP ratio. Denmark stands out as the exception with a mortgage to GDP ratio approaching 130% in recent years whereas the ratio stands at about 80% of GDP both in Norway and Sweden, which represents an increase of about 30 percentage points in both countries since the early 2000s (figure 13). For the Anglo-Saxon economies, it is only Australia that reaches a similar mortgage to GDP ratio of about 80% in recent years. Canada and the U.S. are far less leveraged as the mortgage to GDP ratio is only about half of that in Sweden, for example, and

even the UK only reaches a mortgage to GDP ratio of 60% in recent years (figure 12).
When it comes to changes in the capital share of income, figure 14 shows that the capital share has increased almost in unison in the Anglo-Saxon economies from a low of about 30% in the early 1980s to more than 35% in recent years. The picture for the Scandinavian economies is somewhat more mixed. While Finland and Norway have also seen a marked increase in the capital share similar to the Anglo-Saxon economies, the increase is much less pronounced in the case of Denmark and Sweden (figure 15).

6. The Panel-VAR model

Most economists agree that money is roughly neutral in the long-run, even though there is the objection that at very high inflation rates velocity increases as well (De Grauwe and Polan, 2005). However, a large body of academic literature supports the notion that monetary shocks have real effects in the short-run. Friedman and Schwartz's (1963) account of the Great Depression shows that monetary policy failure can mostly explain the economic downturn of the 1930s. Romer and Romer (1989) find that unexpected monetary policy shocks have large and persistent effects on output and employment. More recently, a number of studies have examined in more detail the monetary transmission mechanism. There is no doubt that monetary policy also affects asset prices in the short to medium-run via adjustments of the key policy rate (Mishkin, 2007b). Furthermore, many studies have confirmed the positive interaction between credit booms and asset price bubbles, particularly real estate (Jorda et al., 2015). Moreover, household debt has increased sharply in many advanced economies, mostly a result of rising mortgage to GDP ratios, with important implications for financial stability as the private sector becomes more and more leveraged (Jorda et al., 2016b). More recently, a number of studies have confirmed that monetary policy shocks also affect inequality. Coibion et al. (2012). for example, show that contractionary monetary policy shocks can have a significant impact on labor income inequality. Following Goodhart and Hofman (2008), we estimate the following Panel-Var equation:

$$(3) \quad Y_{i,t} = A(L)Y_{i,t} + \varepsilon_{i,t}$$

where $Y_{i,t}$ is a vector of endogenous variables and $\varepsilon_{i,t}$ is a vector of errors. A(L) is matrix polynomial in the lag operator whose order is determined by the Akaike information criterion considering orders up to four. The vector of endogenous variables comprises eight key variables of interest: the log difference of real GDP (Δy), the log difference of the consumer price index (Δcpi), the level of the short-term interest rate (ir), the log difference of nominal house prices (Δhp), the log difference of nominal broad money (Δm), the log difference of nominal private credit (Δc). Unlike Goodhart and Hofman (2008), we also include the log difference of nominal stock prices ($\Delta stock$) and the gross capital share ($\mathrm{cap\ share}$) in our model. The vector $Y_{i,t}$ is therefore given by:

$$(4) \quad Y = [\Delta y, \Delta cpi, \mathrm{ir}, \Delta stock, \Delta hp, \Delta m, \Delta c, cap\ share]$$

Our model thus comprises some key monetary variables (inflation, nominal interest rates, money, credit), asset prices (stocks and house prices) as well as two real outcomes (GDP and the functional distribution of income). We can thus determine the interaction between monetary policy, asset prices, and inequality.

The advantage of the Panel-VAR model is that it greatly increases the efficiency and the statistical power of the analysis. Estimating the eight-dimensional VAR model on a country level is simply infeasible given that we do not have enough data points, i.e. the model would suffer from insufficient degrees of freedom. A drawback of the Panel-VAR approach is that it imposes the pooling restriction. We therefore disregard cross-country differences in the estimated dynamic relationship by design. On the other hand, adopting a panel framework in a macro-analysis might help to uncover systematic dynamic relationships, which might otherwise be obscured by idiosyncratic effects on the country level (Gavin and Theodorou, 2005). Usually, time dummies are included in such studies if the cross-section is large. However, in our case, the cross-section is rather small while the time dimension is very large. Including time dummies would thus come at a great cost of efficiency and statistical power.

A common problem one encounters in time series data is spurious correlation because of unit roots. That is why most of the variables of interest, with the exception of the capital share and the nominal interest rate, are expressed in first differences. Before estimating the model, we test whether our variables of interest are stationary. Using the Im-Pesaran-Shin unit-root test (Im et al., 2003) for heterogeneous panels, we do find strong evidence that our variables are stationary across cross-sectional units (we can reject the null hypothesis of unit roots at the 1% level).

In applying the Panel-VAR procedure, we use the "Helmert procedure" suggested by Arellano and Bover (1995). Pooling data imposes the restrictions that the underlying structure is the same for each cross-sectional unit. One way to overcome the restriction is to introduce fixed effects, which allow for individual heterogeneity. However, mean-differencing would create bias since the fixed effects are correlated with the regressors due to lags o dependent variables. The "Helmert procedure" is a transformation that only removes the forward mean. It thus preserves the orthogonality between transformed variables and lagged regressors, which can be used as instruments to estimate the coefficients by System GMM (Love and Zicchino, 2006). This method also has the advantage that estimation is feasible with an unbalanced panel, as is the case with our data.

The Panel-VAR model also allows us to test for Granger causality. Moreover, we can estimate impulse response functions, which describe the reaction of one variable to the innovation of another variable, whilst holding all other shocks equal to zero. We recover the orthogonalized shocks of the system by using a simple Cholesky decomposition (Goodhart and Hofman, 2008) and construct 95% confidence intervals using Monte-Carlo simulations. The ordering of the variables in our system is given by equation (4). According to Love and Zicchino (2006), the particular ordering of the variables is quite important as the variables that appear earlier in the system are more exogenous while the variables that appear later are more endogenous: The identifying assumption is that the variables that come earlier in the ordering affect the following variables contemporaneously, as well as with a lag, while the variables that come later affect the previous variables only with a lag (Love and Zicchino, 2006). We follow closely the approach used by Goodhart and Hofman (2008) who argue that the ordering of the first three variables (GDP growth, inflation, and interest rates) is standard in the monetary transmission mechanism. The ordering of the remaining variables is somewhat arbitrary. Credit was ordered after money because it is more plausible to assume an immediate effect of a change in the money stock on credit rather than vice-versa (Goodhart and Hofman, 2008). Finally, the capital share is the variable that is the most endogenous in our system. Robustness checks, however, suggest that the particular ordering of the variables does not have a substantial effect on the results.

6. Empirical results

We estimate equation (1) with System GMM, using lags one to four as instruments in the estimation procedure. We choose to estimate the Panel-VAR model with only one lag of the endogenous variables based on the Akaike and Schwarz information criteria. We estimate the system for the entire panel, (1875-2013), as well as for several subsamples, which correspond to different macroeconomic regimes.

1) 1875 - 2013: Entire sample
2) 1875 - 1930: Gold standard
3) 1930 - 2013: Interwar and post WW II
4) 1945 - 1980: Post WW II
5) 1980 - 2013: Neoliberalism

The post World War II (WW II) period is split into two subsamples. The first three decades after the war were characterized by macroeconomic policies that can be labeled as Keynesian demand management, which ultimately culminated in the high inflation rates of the 1970s. The last period can be characterized as neoliberalism. It also corresponds to the time period where Central Banks across advanced economies have adopted some kind of inflation targeting regime. It has been argued that modern Central Banking has greatly contributed to the macroeconomic stability after 1980, a period that is also known as the Great Moderation (Bernanke, 2004).

We test all of the Panel-VAR models for stability, i.e. that the modulus of each Eigenvalue is less than one. An unstable Panel-VAR would imply that shocks to the system would never die out, but rather explode (Abrigo and Love, 2016). We find that the stability of the Panel-VAR model is satisfied for the entire time period, 1875 to 2013, and for two of our subsamples: 1930 - 2013 as well as the modern regime from 1980 to 2013. We can thus proceed with estimating Impulse response functions for the system. For the two other subperiods, we find that one of the Eigenvalues is larger than one. We thus have to proceed with caution in interpreting the obtained Impulse Response functions as the system suffers from instability.

Table 5 summarizes the results from our Panel-VAR analysis and table 6 summarizes the results from the Granger causality test. Our findings are generally in line with prior expectations. We find a positive correlation between the money stock and asset prices, especially stock prices but also house prices. This result seems to be robust as it holds across different time periods in our panel. In terms of Granger causality, we find that that money growth Granger causes asset price growth, but not necessarily vice-versa. This one-directional relationship is statistically significant at the 1% level. We also find a positive relationship between credit growth and asset prices. More specifically, asset price growth seems to predict subsequent credit expansions. This result is intuitive insofar as it rests upon the aforementioned wealth effect (Mishkin, 2007a). As the value of the market portfolio increases, consumption tends to increase as well since consumers are more wealthy. Moreover, part of the consumption can be debt-driven as higher asset prices can serve as a collateral against consumer credit. In terms of Granger causality, we find a two-directional relationship between credit and asset prices. This result is statistically significant. Moreover, the relationship can be confirmed across different time periods in our panel.

When it comes to the capital share, we find a positive relationship with private sector credit growth. This relationship is very robust across all time periods and Granger causality between the two variables can be confirmed at the 1% level in both directions. The effects of GDP growth, inflation, and interest rates on the capital share seem to be time-varying and highly dependent on the macroeconomic regime. Inflation is mostly negatively correlated with the capital share, bar the last period, which corresponds to the time period of modern Central Banking and the emergence of the 2% inflation target across advanced economies.

In terms of asset prices, we do find the expected positive effect between stock price growth and the capital share. The result holds across all time periods. In terms of Granger causality, we do find strong evidence that stock prices Granger cause the capital share. When it comes to housing, we find a negative correlation between house prices and the capital share. Moreover, the result is statistically significant and robust across all time periods. This effect is contrary to our expectations and hard to explain.

Last but not least, we estimate impulse response functions (see end of the appendix) with Monte Carlo simulations using 200 draws for the three Panel-VAR models that display stability: Estimations (1), (3), and (5). We find that a shock to nominal stock prices positively affects the capital share, but the effect dies out after about three time periods (years). There is a similar effect concerning the money stock, but the shock disappears even more quickly. Shocks to the interest rate and shocks to house prices have a negative impact on the capital share. Again, the effect dies out after a few time periods. As mentioned above, the negative correlation between the capital share and house prices we find in our data is unexpected and contrary to our expectations.

We also estimate the same Panel-VAR model by using the net capital share instead of the gross capital share as a robustness check. The net capital share is defined by Bengtsson and Waldenström (2015) as capital income net of depreciation divided by net output. While most of the results do not differ substantially, we now find the positive expected relationship between house prices and the capital share. However, the Panel-VAR model does not display stability, which suggests that the model is not applicable. Consequently, some of the estimated impulse response functions display persistent shocks, casting some doubt on the validity of this last estimation.

7. The Panel-OLS model

In the spirit of Stockhammer (2013), we also estimate a Panel-OLS model to examine the main determinants of the functional distribution of income. The advantage of the Panel-OLS model compared to the Panel-VAR approach is that we can incorporate more control variables into the analysis. More specifically, the capital share is a function of variables that measure economic growth and technological change, the business cycle, globalization, and financialization:

(6) Capital share = f(growth, business cycle, globalization, financialization)

This approach is consistent with the political economy and power resource theory approach where the functional distribution of income is determined as a result of a bargaining process between capital and labor instead of being the natural outcome of market clearing processes, as emphasized by the neoclassical approach (Stockhammer, 2013). We thus estimate the following Panel-OLS model with country fixed-effects that is supposed to capture the relationship described by equation (6). In order to avoid a large loss of efficiency, we do not include time fixed-effects because the time dimension is relatively large while the cross-section is relatively small.

$$(7) \quad cap.share_{i,t} = A_i + \beta_1 \Delta house\ price_{i,t} + \beta_2 \Delta stock\ price_{i,t} + \Delta X' \beta_{3_{i,t}} + \varepsilon_{i,t}$$

where A_i are the country fixed-effects and $X'_{3_{i,t}}$' represents the vector of control variables that are based on the academic literature summarized above. The following is a list of control variables that we include the regression, most of them are being measured as first differences, if appropriate, to address the problem of unit roots by making the time series data stationary:

1) Real GDP growth
2) Output gap
3) Interest rates
4) Inflation
5) Money growth
6) Credit growth
7) Trade openness

We calculate the output gap for real GDP using the standard Hodrick-Prescott filter (Hodrick and Prescott, 1998) and a smoothing parameter of $\lambda = 6.25$. There is some debate on the validity of the HP filter. More specifically, the estimated cycle component will depend on the smoothing parameter, which is chosen somewhat arbitrarily. For annual data any value of λ between 6.25 and 100 might be appropriate. We use the lower bound, which was suggested as appropriate for annual data by Ravn and Uhlig (2002). Some other well-known problems associated with the HP filter are that it performs poorly in the beginning as well as the end of the data (Hamilton, 2017). Furthermore, applying the HP filter to real GDP, we find a large positive output gap for the U.S. for the time period before the Great Depression and a somewhat smaller than expected negative output gap during the Great Depression itself. This literally suggests that potential GDP was far above trend in the late 1920s, which might be somewhat unreasonable. It seems more realistic to assume that GDP was actually close to trend before the Great Depression and that the subsequent negative output gap was actually close to the actual decline in real GDP.

More recently, Hamilton (2017) has suggested an alternative approach to find the cyclical component of a time series variable x_t. He proposes to regress x_{t+h} (with h usually being equal to 3) on up to four lags of x_t. The residual of such a regression are then equal to the cyclical component of the variable x_t. However, when we apply such an approach to real GDP we find unusually large cyclical components with output gaps that are unrealistically big and largely exceed those obtained from the HP filter. Consequently, for all its drawbacks, we use the HP filter approach, which remains one of the most commonly applied techniques in empirical macroeconomics papers (Hamilton, 2017).

As before, we estimate the regression for the entire time period as well as for the various subsamples. Table 7 displays the baseline regression without including asset price growth. The results we obtain are similar to what is found in the academic literature. The output gap displays a positive relationship with the capital share. This result is very robust as it holds across almost all time periods. This is indicative of the procyclical behavior of markups that was found by Nekarda and Ramey (2013). Short-term interest rates are mostly negatively correlated with the capital share. The effect of real GDP growth and inflation seems to be time-varying. Only after 1980 we do find a positive relationship between income growth and the capital share. Trade openness is positively correlated with the capital share, but depending on the subsample this finding is not always robust as the variable is statistically insignificant in some of the subsamples. This result is in line with Stockhammer (2013) who finds evidence that globalization decreases the labor share because it reduces the bargaining power of workers who have to compete increasingly with foreign labor. Government expenditures are consistently negatively correlated with the capital share. This is not very surprising as the government sector does not contain a profit share (Stockhammer, 2013).

In specification 2 (table 8) we include nominal stock prices and nominal house prices in first differences, i.e. growth rates, as well as two lags of the variables. The appropriate lag order was chosen based on the Akaike information criterion considering lags of up to two time periods. We find that stock prices are consistently positively correlated with the capital share. This also seems to be true for the lagged variables that we have included in order to address the issue of reverse causality between the capital share and asset prices: The idea is that current values of the capital share cannot cause past values of asset price growth whereas past asset booms might very well lead to subsequent changes in the functional distribution of income.

An increase in stock prices by 10% is associated with an increase in the capital share of about 0.2 to 0.35 percentage points, depending on the time period under consideration. The two lagged variables for stock prices have roughly the same economic effect on the capital share and are also statistically significant. Nominal house prices, on the other hand, seem to be insignificant throughout the entire period under consideration.
In specification 3 (table 9) we include 3-year moving averages for stock prices and house prices. This does not significantly alter the results for house prices, but the correlation between stock prices and the capital share now appears to be even stronger and also economically significant: An increase of 10% in the 3-year moving average of nominal stock prices is associated with an increase in the capital share of about 0.3 to 0.75 percentage points, depending on the time period under consideration.

8. Bubble indicators:

As noted before, there is a large academic literature on asset price bubbles and debt. Reinhart and Rogoff (2009), for example, have documented that financial crises and asset price bubbles have occurred relatively frequently across both advanced economies and emerging markets over the last two centuries. While in the last section we simply examined the interaction between asset price growth and the capital share, we also test for the significance of financial bubbles by using three different indicators.
First, we test whether it is asset price growth above trend that matters. In specification (4), we use the first difference of the growth rate, which can be interpreted as an acceleration of the growth rate. That is because the second difference of a variable is conceptually similar to the second derivative. We find that an acceleration in nominal stock price growth seems to be insignificant. The house price variable, on the other hand, now appears to be significant throughout most time periods. This is true for the first difference in the growth rate as well as its first lag. This result might suggests that it is not so much increases in house prices but rather house price accelerations that can have a positive effect on the capital share (table 10).
Second, we also apply the Hodrick-Prescott filter to estimate the cyclical component for stock prices and house prices in order to determine aberrations from the long-run trend. Similar to GDP, we use the smoothing parameter of $\lambda = 6.25$ and then calculate the gap between the actual value and its the long-run trend. We can use this value as a "bubble indicator" since large positive deviations between actual asset prices and the estimated trend can be indicative of booms, maybe driven by speculative behavior. We find that stock price growth above trend and its lag is mostly statistically significant while house price growth above trend is insignificant. This result is quite robust across different time periods (table 11).
Last but not least, we also calculate the mean as well as the standard deviation of nominal stock price growth and nominal house price growth for all countries in our database (table 14). We then standardize each year's growth by calculating the deviations from the mean in terms of one standard deviation. This estimator is supposed to be an indicator of above-trend asset price growth, i.e. financial bubbles. We find that the variable for above-trend stock price growth as well as its lag is statistically significant. Again, this

finding seems to be robust and holds across different subsamples. On the other hand, we cannot detect such a statistically significant effect for the house price variable (table 12).
Finally, we estimate all previous regressions using the OECD capital share data as a robustness check. The OECD data is defined as total employee compensation as share of gross value added (ILO, 2015). The correlation between the OECD capital share data and the gross capital share from the Bengtsson-Waldenström database (2015) is about 0.25 while the correlation between the first difference of the two variables is significantly higher with a value if about 0.85. The OECD data starts in 1970 and thus only covers our last subsample. We now estimate all the previous specifications using the OECD data instead (table 13). The results are roughly in line with the findings from above with a few notable exceptions. The effect of the output gap is now statistically insignificant. GDP growth, on the other hand, is now statistically significant and positively correlated with the capital share. The trade openness variable is now significant, but only at the 10% level. Finally, in terms of asset prices, the effect of stock prices is still significant but somewhat smaller than before. More importantly though, the housing variable now has the expected sign and is statistically significant. The 3-year moving average of nominal house price growth, equation (3), is now statistically significant at the 5% level and the effect also seems to be economically significant: An increase of 10% in the 3-year moving average of nominal house price growth is now associated with an increase of about 0.5 percentage points in the capital share.

9. Interpretation of results and policy implications

Using two separate models, a Panel-VAR approach as well as a more standard Panel-OLS, we have found conclusive evidence for the interaction between asset price growth and the capital share of income. Our results suggest that high asset price valuations might not only increase wealth, but also affect the functional distributional of income by increasing the capital share of GDP. Across various specifications, we have found a statistically significant and also economically significant effect of asset price growth on the capital share. The result seems to be more pronounced for the stock market than for the housing market. Stock markets have reached historically high valuations and in many advanced economies in recent years as total market capitalization often exceeds one year's GDP. In the end, it is not surprising that growth in the stock market ultimately translates into higher capital income. The effect of home prices, on the other hand, might be more muted for two reasons. First, house prices have stayed fairly constant in real terms in advanced economies for a long time period and only started to increase rapidly form the 1960s onwards. Second, home ownership is relatively high in many of the countries in our dataset.
More recently, Larry Summers (2014) has argued forcefully that advanced economies have entered a new growth regime, the secular stagnation outcome, which translates into lower real growth rates and a much lower natural or Wicksellian rate of interest. Low interest rates support high asset valuations for two reasons. First, the natural mechanism by which all future income streams are discounted with a lower rate of interest. Second, it might

encourage a certain reach for yield and speculative behavior. As such, our analysis shows that in the secular stagnation outcome one might also have to expect a lower labor share as high market valuations tilt away income from labor to capital (as a percentage of GDP). The distributional consequences are potentially large since capital tends to be highly concentrated. This should concern policy makers not only for equity reasons, but also for growth performance reasons, as high levels of inequality tend to be associated with lower growth rates. Policy makers can address this somewhat worrying trend by implementing some key economic policies that would curb the surge in capital incomes. Piketty (2014) and Piketty and Saez (2012), for example, have suggested a higher taxation on capital income as well as an increase in the estate tax/inheritance tax.

10. Conclusion:

We have documented the spectacular increase in private sector leverage in all advanced economies in recent decades. A significant portion of this is related to the increase in the mortgage to GDP ratio. The expansion of private sector credit is thus ultimately linked to the housing market, which has seen a marked increase in price appreciation in recent decades. Private sector leverage cannot increase indefinitely. Similarly, real house prices also have some upper bound. There is some reason to believe that a portion of the growth achieved since the 1980s was bought by cheap credit. Insofar as we now have reached a period of deleveraging after the crisis, one might also expect a period of lower growth in the years to come. It is somewhat surprising that credit and asset growth was even more pronounced in the Scandinavian countries than in the Anglo-Saxon economies. The trends in the housing and mortgage market combined with the recent increase in the capital share suggest that the Scandinavian economies are not insulated from what seem to be global macroeconomic trends. Low global real interest rates will probably support high asset valuations in the years to come.

Furthermore, in terms of changes in wealth inequality the Nordics might not be that special after all. The stark appreciation of real house prices largely favors home owners who tend to be more wealthy, on average. Similarly, the rise in the capital share also favors asset owners. These two trends are thus exacerbating inequality because asset ownership tends to be highly concentrated in society. Table 15 shows that there is a strong correlation between top income shares and the capital share of income. This result is not very surprising. In the U.S., for example, more than 80% of the stock market value is held by the top 10% (Wolff, 2016). Roine and Waldenström (2012) have shown that the Swedish stock market has performed particularly well since the financial liberalization in the 1980s. Large capital gains have contributed to a rise in wealth for the top income shares. The Bengtsson-Waldenström database also contains data for top income shares.

In terms of the capital share, our data reveals that the gross capital share has increased more quickly than the net capital share in recent decades. This suggests that part of the decline in labor income as a share of GDP can simply be attributed to higher economy-wide depreciation. It is open to debate whether depecriation rates have increased in recent decades because ICT capital becomes obsolete more quickly, whether higher economy-wide

depreciation is simply the result of capital deepening, whether this is simply a measurement error, or a combination of all these factors combined.
Using various statistical methods, we have found strong evidence that stock price appreciations have a causal effect on the functional distribution of income. The result is statistically signifcant across various specifications and also appears to be economically singificant, with increases in nominal stock prices of 10% leading to about an increase in the capital share of income of about 0.2 to 0.35 percentage points. The result for house prices is somewhat mixed and seems to depend on the time period under consideration, the model at hand, and even the dataset for capital income. Furthermore, we did not address the question of imputed rents in our analysis. Home ownership greatly differs across time periods and countries. As high house prices would lead to higher imputed rents, this would basically lead to an increase in the capital share by definition. Moreover, this effect could be large enough in certain countries so that a higher capital share might simply reflect a statistical anamoly in the national accounts. This would be in line with the findings by La Cava (2016). Our findings are important insofar as the "secular stagnation" outcome suggested by Larry Summers would also imply rich asset valuations, low real interest rates, and high private sector leverage in the years to come. Our model suggests that this could also affect the functional distribution of income and further tip the balance away from labor income towards capital income.

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Appendix:

Figure 1: Average gross and net capital share

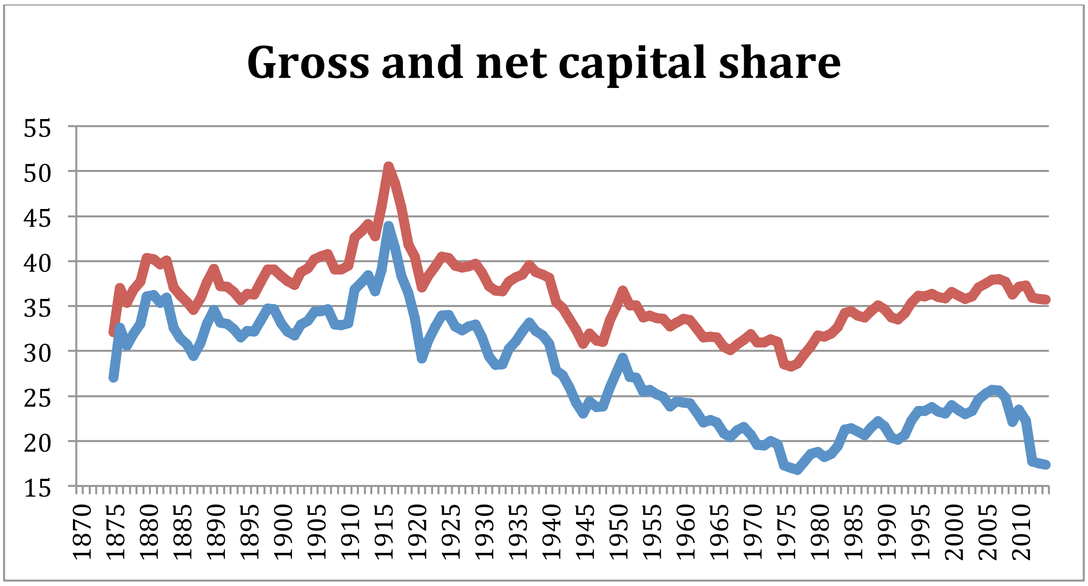


Figure 2: Average short-term and long-term nominal interest rates

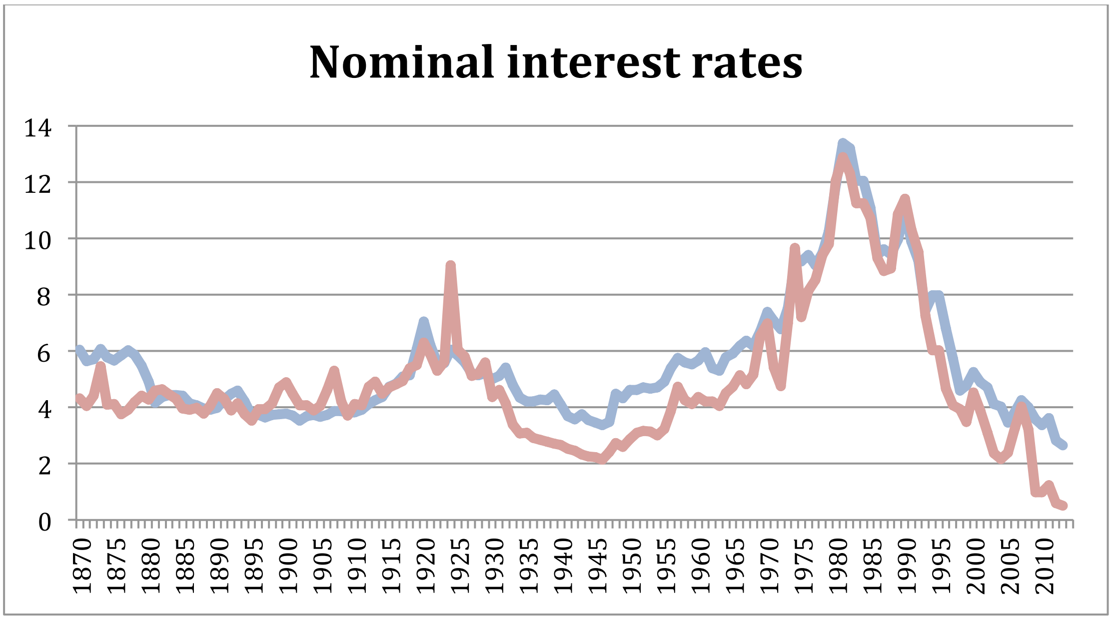


Figure 3: Average investment share of GDP

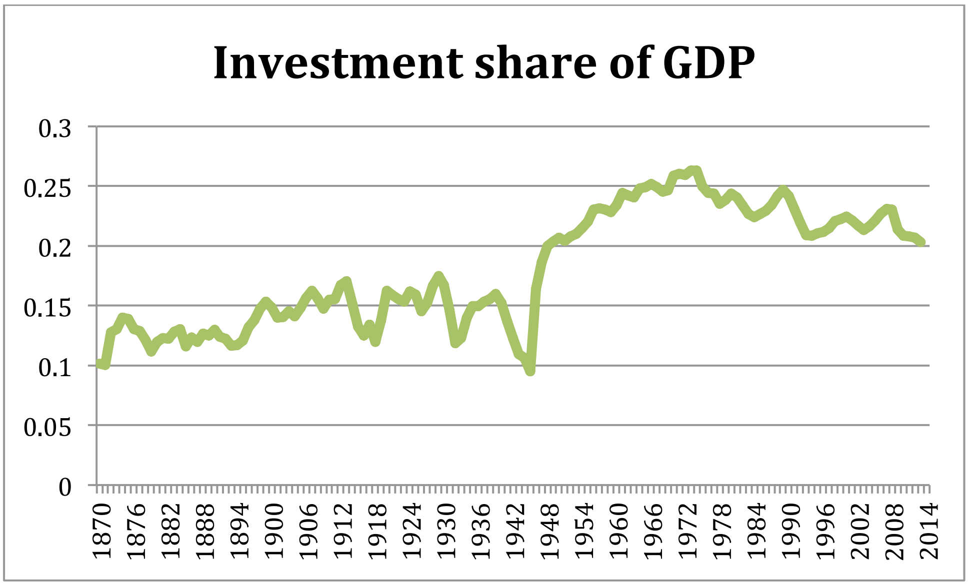


Figure 4: Average economy-wide depreciation as a % of GDP

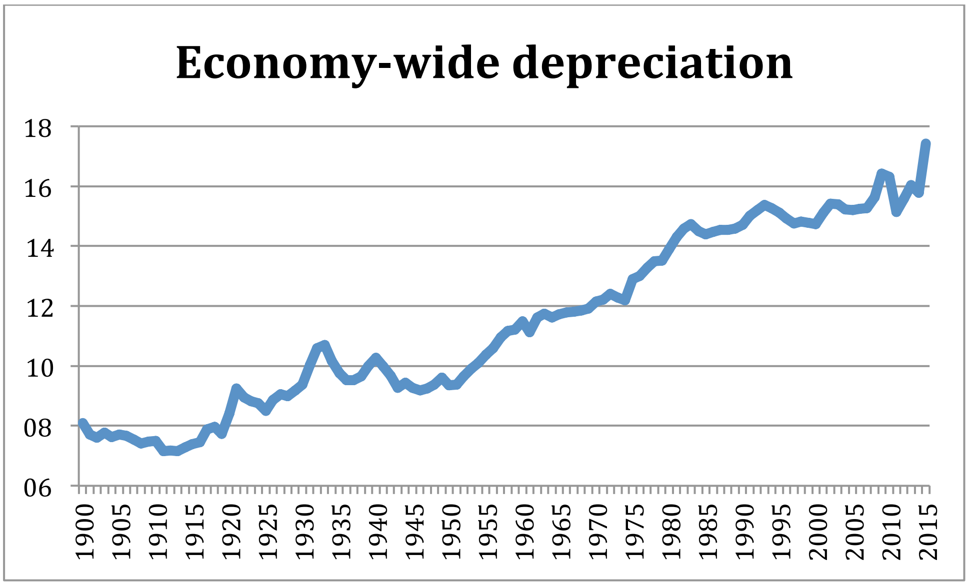


Figure 5: Average depreciation rate

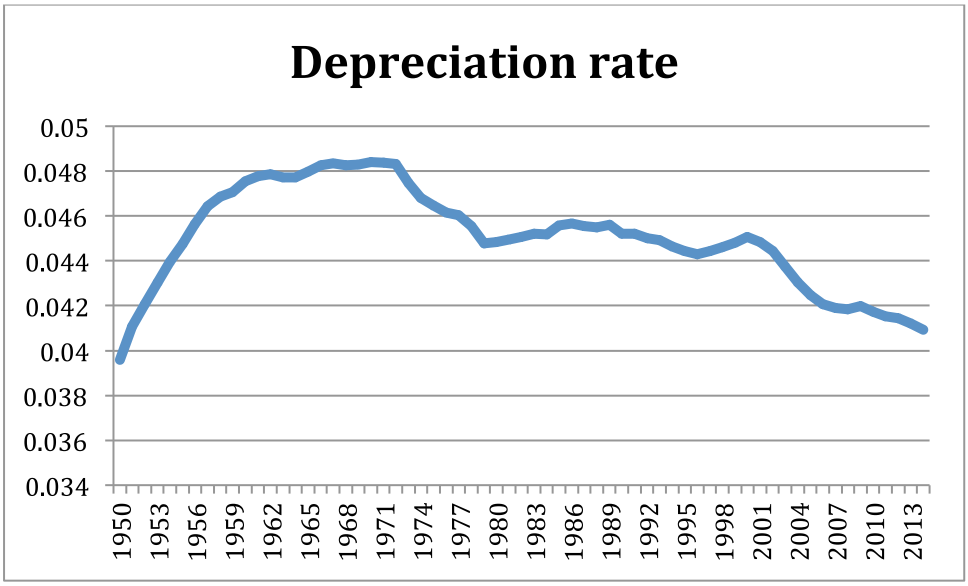


Figure 6: Average capital-income ratio

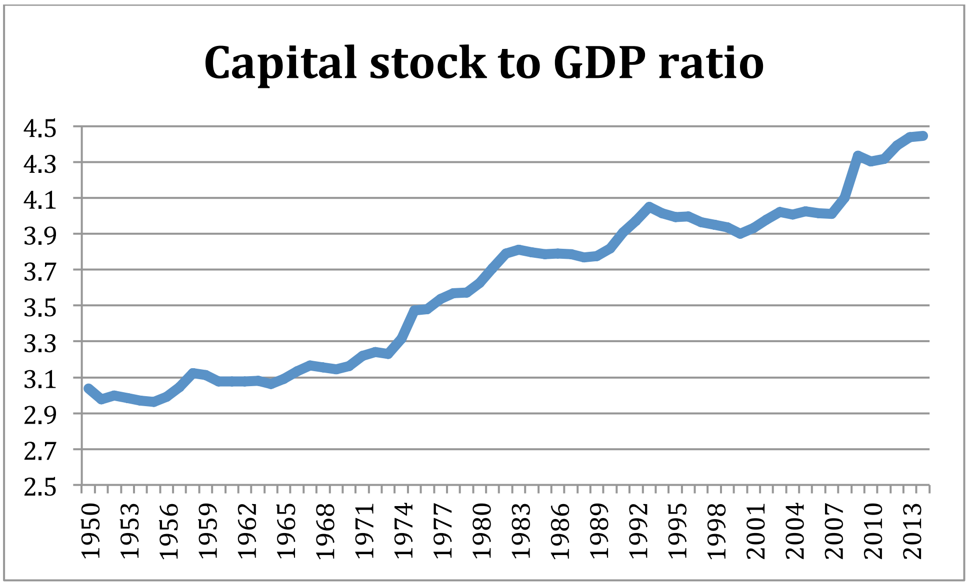


Figure 7: Average public debt to GDP ratio

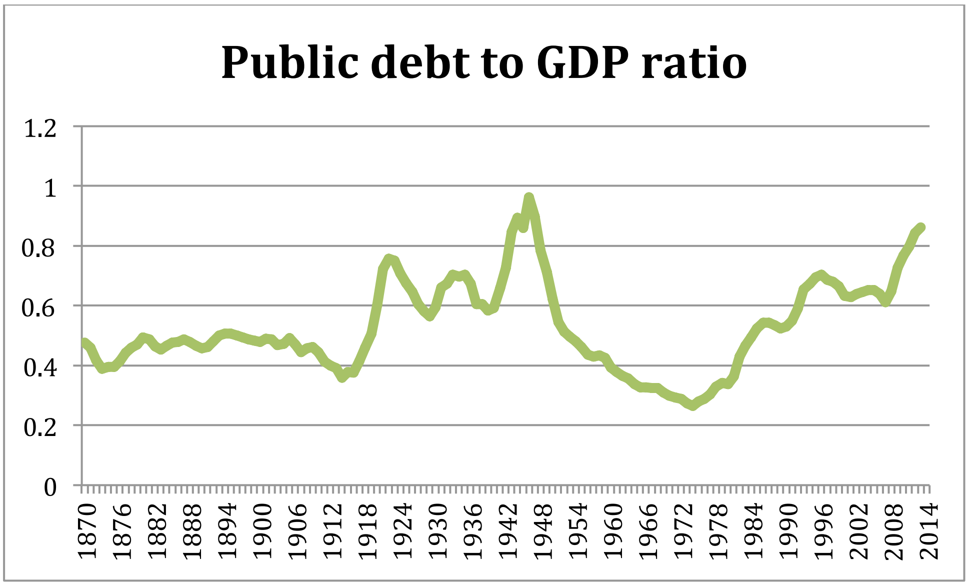


Figure 8: Average total private sector loans to GDP ratio and mortgage to GDP ratio:

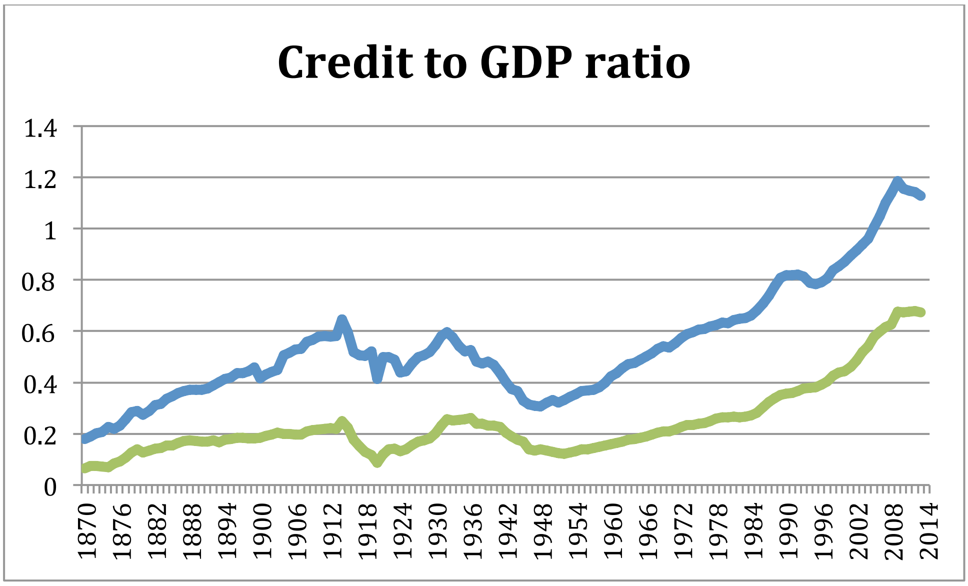


Figure 9: Average inflation-adjusted house prices

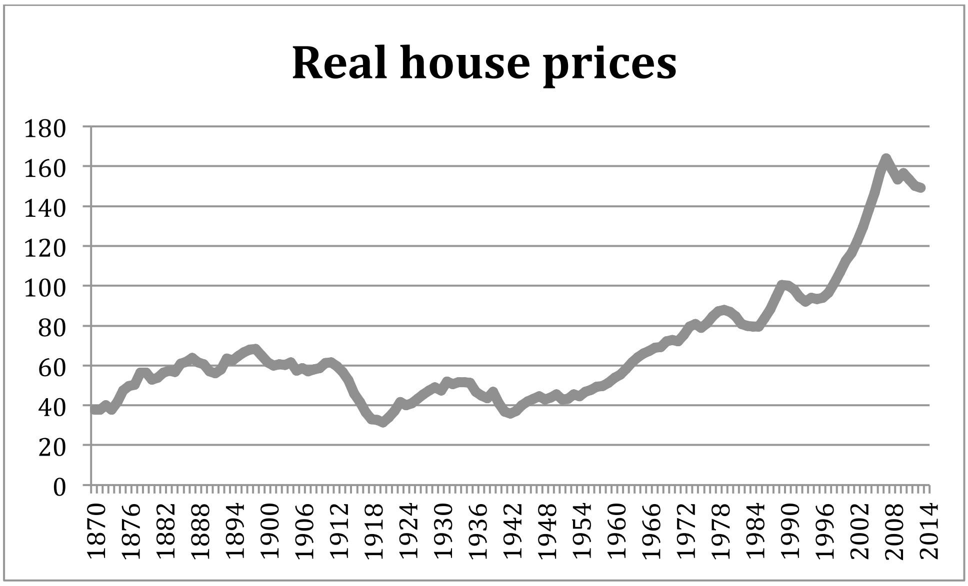


Figure 10: Inflation-adjusted house prices, Anglo-Saxon countries

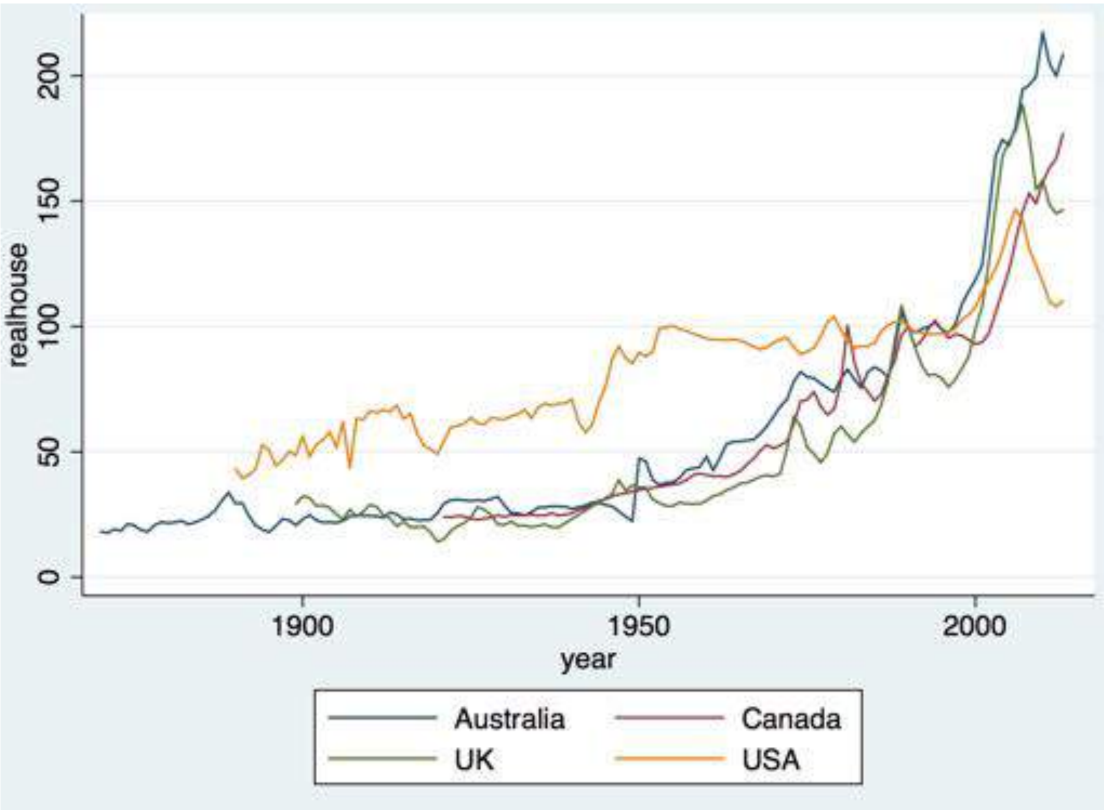


Figure 11: Inflation-adjusted house prices, Nordic countries

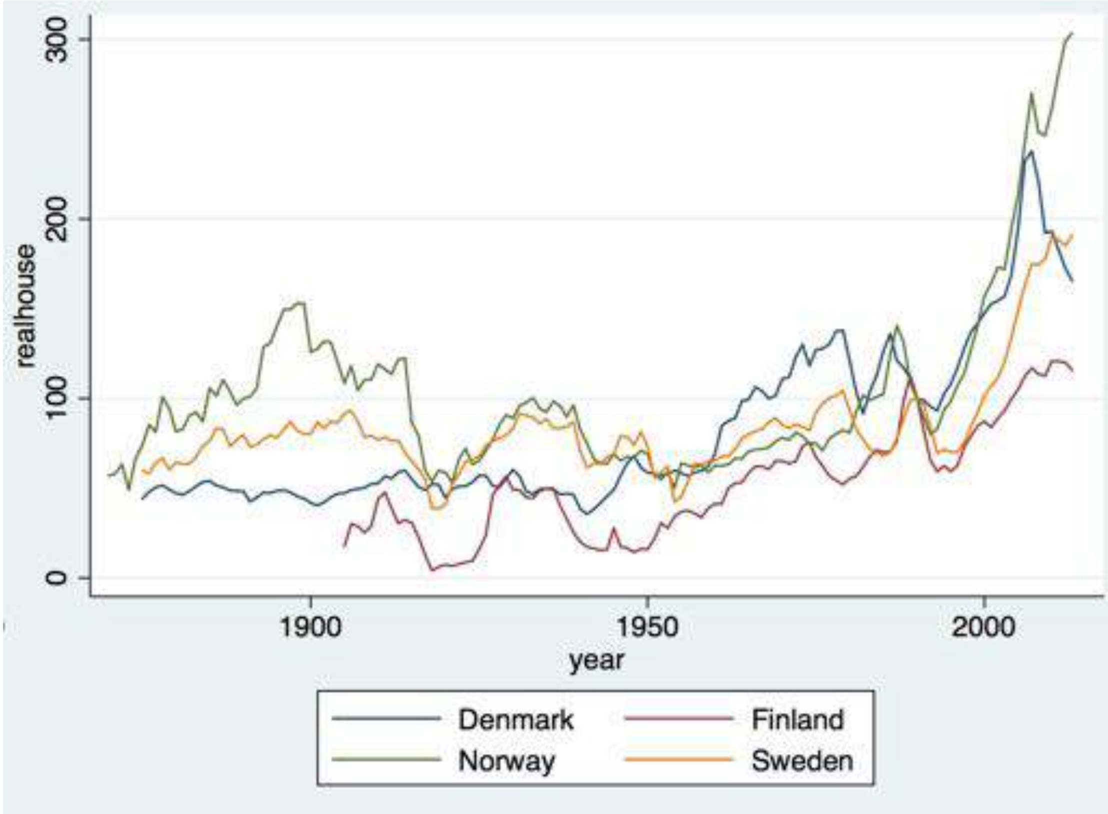


Figure 12: Mortgage to GDP ratio, Anglo-Saxon countries

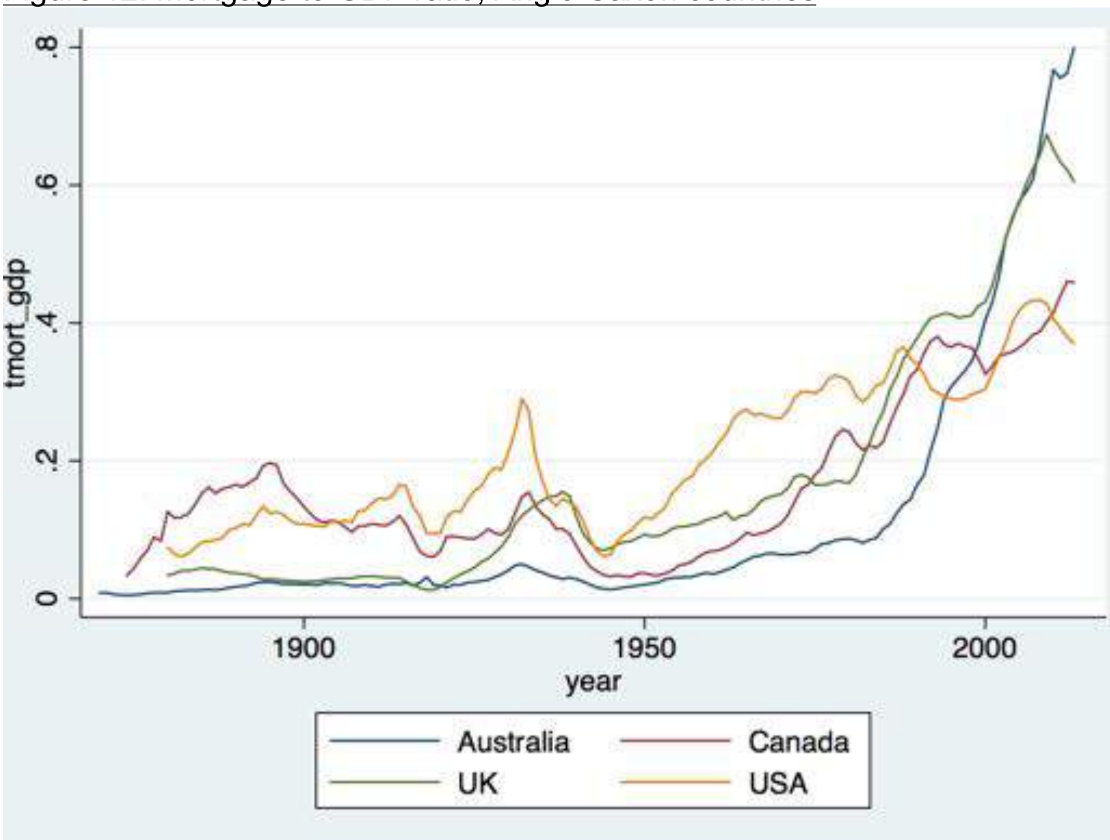


Figure 13: Mortgage to GDP ratio, Nordic countries

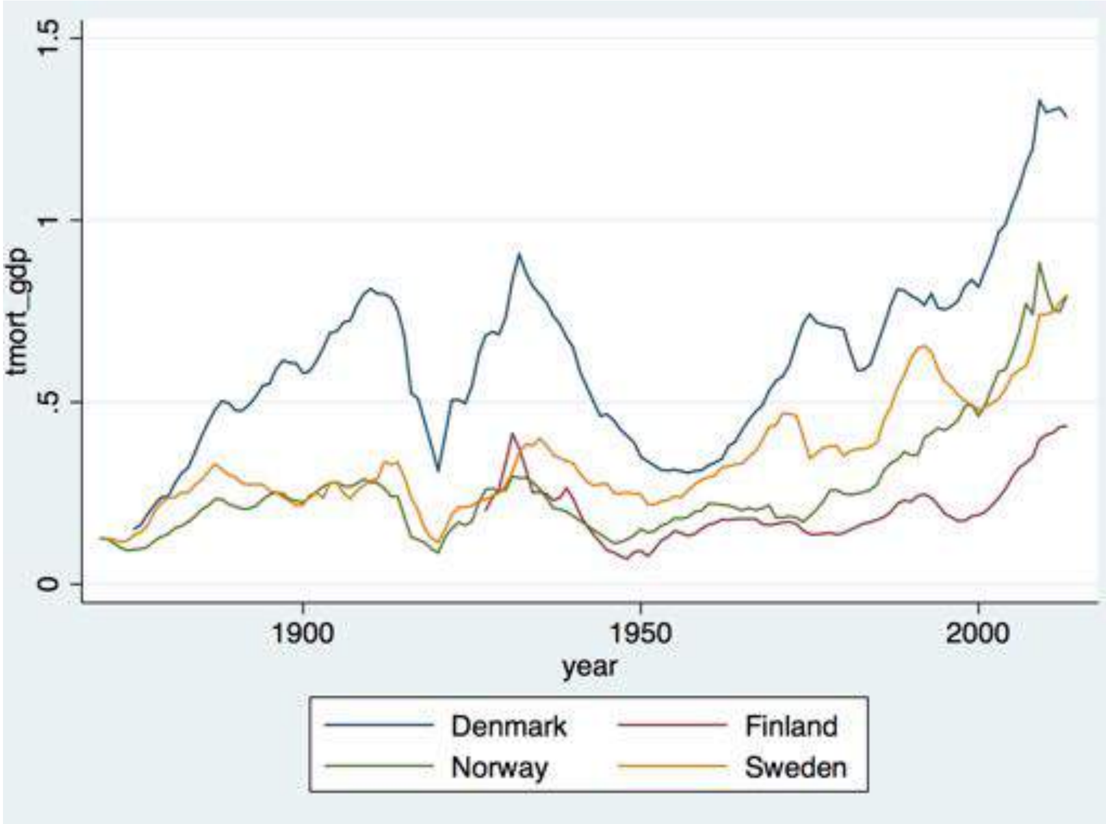


Figure 14: Gross capital share, Anglo-Saxon countries

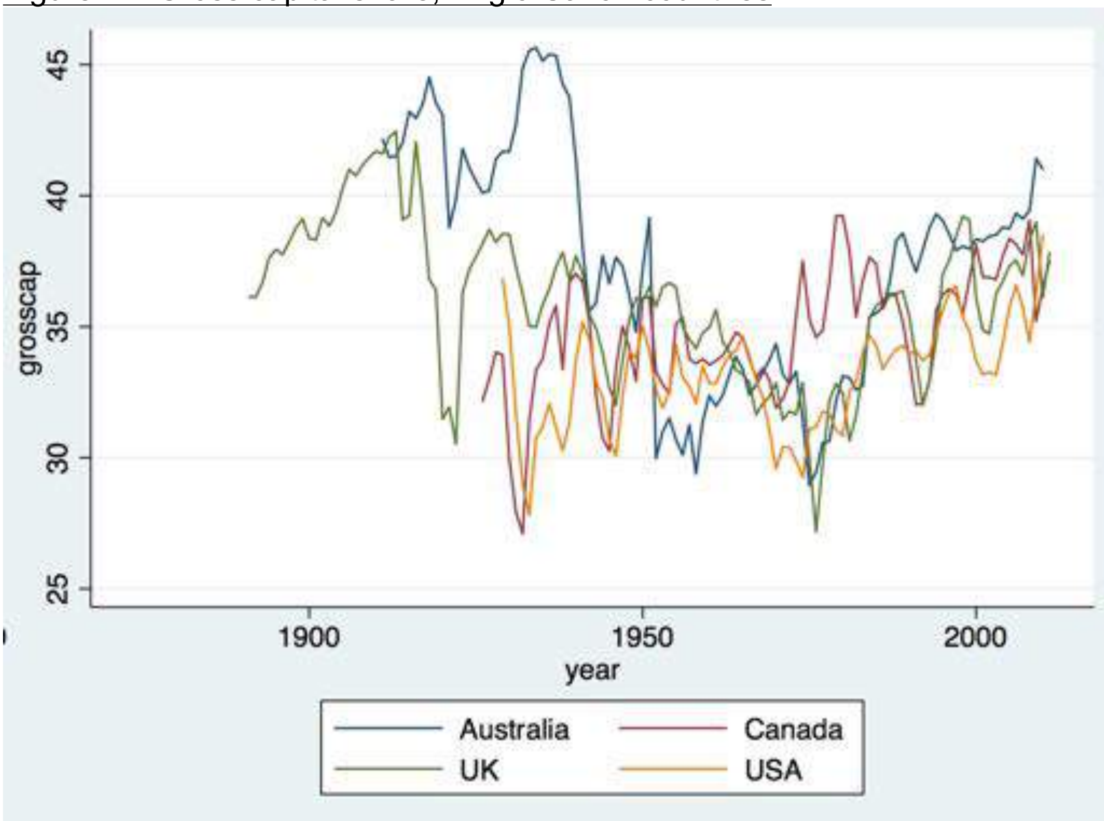


Figure 15: Gross capital share, Nordic countries

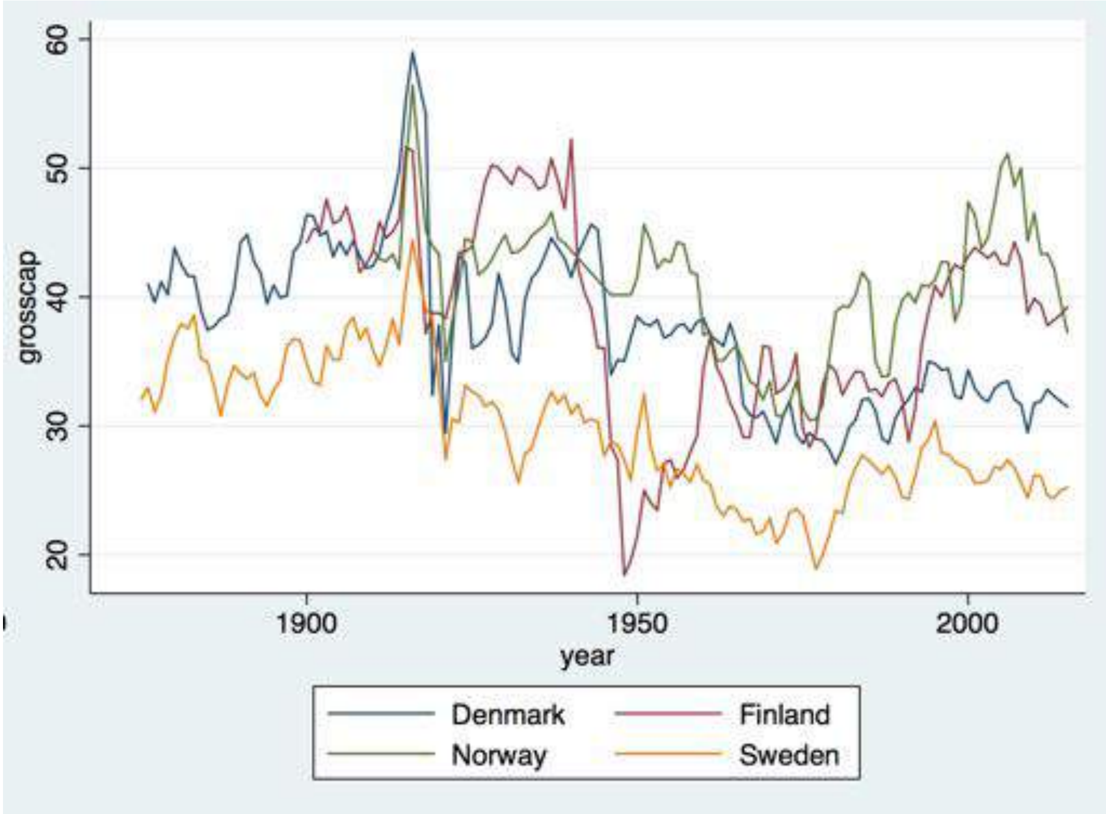


Table 1: List of countries and data availability

Country	Capital share data
Australia	1911 - 2010
Belgium	1960 - 2015
Canada	1926 - 2011
Denmark	1876 - 2015
Finland	1900 - 2015
France	1900 - 2010
Germany	1891 - 2011
Italy	1911 -2015
Japan	1906 - 2010
Netherlands	1923 - 2010
Norway	1910 - 2015
Portugal	1970 - 2014
Spain	1900 - 2000
Sweden	1875 - 2015
Switzerland	1980 - 2014
UK	1891 - 2011
USA	1929 - 2010

Table 2: Linear time trend model and structural break test

Country	Variable	Starting date	Structural break	Break Year	Structural break test	Entire sample	Pre-break	Post-break
Australia	Ln_real house	1870	YES	1992	0.00***	0.016	0.013	0.046
	Mortg_gdp	1951	YES	1989	0.00***	0.012	0.002	0.028
	Loans_gdp	1947	YES	1986	0.00***	0.018	0.002	0.042
Belgium	Ln_real house	1917	YES	1939	0.00***	0.017	0.033	0.024
	Mortg_gdp	1950	YES	2001	0.00***	0.005	0.003	0.019
	Loans_gdp	1950	YES	1994	0.00***	0.009	0.013	0.006
Canada	Ln_real house	1954	YES	1996	0.00***	0.025	0.027	0.043
	Mortg_gdp	1874	YES	1945	0.00***	0.002	-0.001	0.007
	Loans_gdp	1870	YES	1941	0.00***	0.002	0	0.01
Switzerland	Ln_real house	1901	YES	1952	0.00***	0.007	0.002	0.004
	Mortg_gdp	1870	YES	1946	0.00***	0.005	0.009	0.014
	Loans_gdp	1870	YES	1941	0.00***	0.004	0.016	0.01
Germany	Ln_real house	1961	YES	1971	0.00***	0	0.074	-0.006
	Mortg_gdp	1949	YES	1999	0.00***	0.007	0.005	-0.002
	Loans_gdp	1949	YES	1999	0.00***	0.013	0.015	-0.013
Denmark	Ln_real house	1875	YES	1961	0.00***	0.011	0.002	0.013
	Mortg_gdp	1875	YES	1944	0.00***	0.003	0.006	0.013
	Loans_gdp	1875	YES	1941	0.00***	0.005	0.016	0.015
Spain	Ln_real house	1971	YES	2004	0.00***	0.034	0.03	-0.049
	Mortg_gdp	1946	YES	1993	0.00***	0.012	0	0.043
	Loans_gdp	1946	YES	2003	0.00***	0.016	0.009	0.047
Finland	Ln_real house	1905	YES	1925	0.00***	0.018	-0.095	0.018
	Mortg_gdp	1927	YES	1944	0.00***	0.001	-0.008	0.003
	Loans_gdp	1870	YES	1941	0.00***	0.004	0.007	0.008
France	Ln_real house	1870	YES	1960	0.00***	0.01	-0.013	0.024
	Mortg_gdp	1950	YES	1998	0.00***	0.006	0.005	0.021
	Loans_gdp	1950	YES	1995	0.00***	0.009	0.01	0.02
Great Britain	Ln_real house	1945	YES	1958	0.00***	0.028	-0.025	0.032
	Mortg_gdp	1880	YES	1982	0.00***	0.004	0.002	0.014
	Loans_gdp	1880	YES	1967	0.00***	0.006	0	0.02
Italy	Ln_real house	1970	YES	1983	0.00***	0.015	0.057	0.015
	Mortg_gdp	1870	YES	1992	0.00***	0.002	0.001	0.021
	Loans_gdp	1870	YES	1992	0.00***	0.005	0.004	0.023

Japan	Ln_real house	1936	YES	1958	0.00***	0.048	-0.012	0.017
	Mortg_gdp	1946	YES	1967	0.00***	0.007	0.001	0.008
	Loans_gdp	1946	YES	2000	0.00***	0.01	0.01	-0.002
Netherlands	Ln_real house	1870	YES	1936	0.00***	0.006	0	0.023
	Mortg_gdp	1945	YES	1998	0.00***	0.01	0.006	0.009
	Loans_gdp	1945	YES	1975	0.00***	0.02	0.008	0.03
Norway	Ln_real house	1871	YES	1976	0.00***	0.003	-0.004	0.037
	Mortg_gdp	1946	YES	1986	0.00***	0.009	0.003	0.02
	Loans_gdp	1946	YES	1970	0.00***	0.011	0.011	0.015
Portugal	Ln_real house	1988	YES	2000	0.00***	-0.008	-0.001	-0.03
	Mortg_gdp	1920	YES	1995	0.00***	0.005	0.002	0.025
	Loans_gdp	1920	YES	1987	0.00***	0.013	-0.006	0.043
Sweden	Ln_real house	1875	YES	1993	0.00***	0.004	0.001	0.061
	Mortg_gdp	1871	YES	1946	0.00***	0.003	0.001	0.007
	Loans_gdp	1871	YES	1936	0.00***	0.003	0.004	0.009
USA	Ln_real house	1890	YES	1946	0.00***	0.008	0.007	0.004
	Mortg_gdp	1880	YES	1936	0.00***	0.002	0.002	0.004
	Loans_gdp	1880	YES	1935	0.00***	0.002	0.005	0.005

Table 3: Correlation between total prviate sector loans and mortgages:

Correlation coefficient	$mortgage/GDP$
$loan/GDP$	0.906

Correlation coefficient	$\Delta\ mortgage/GDP$
$\Delta\ loan/GDP$	0.7

Table 4: Correlation between house price changes and credit growth

	$\Delta real\ house\ price$
$\Delta\ loan/GDP$	0.17
LAG 1 ($\Delta\ loan/GDP$)	0.124
LAG 2 ($\Delta\ loan/GDP$)	0.039
$\Delta\ mortgage/GDP$	0.154
LAG 1 ($\Delta\ mortgage/GDP$)	0.098
LAG 2($\Delta\ mortgage/GDP$)	0.009
$\Delta\ real\ stock\ price$	0.163

Table 5: Panel-VAR model. estimation with GMM

		(1)	(2)	(3)	(4)	(5)
		1875 - 2013	1875 - 1930	1930 - 2013	1945 - 1980	1980 - 2013
	LAG (1)	1158	205	936	345	506
Δy	Δy	0.33***	0.1***	0.55****	0.25***	0.25***
	Δcpi	-0.14***	-0.03	-0.08****	0.19***	-0.56***
	ir	-0.001	-0.003***	-0.002***	-0.003***	0
	$\Delta stock$	0.02***	-0.93***	0.03****	-0.006	0.04***
	Δhp	-0.15***	0.05***	-0.04**	-0.09***	0.11***
	Δm	0.47***	0.09*	0.28***	0.74***	0.11***
	Δc	-0.02	-0.09***	-0.18****	-0.23***	-0.17***
	$cap\ share$	0	-0.002***	-0.003***	0.004***	-0.006***
Δcpi	Δy	-0.3***	-0.83***	0.18***	0.35****	0.34***
	Δcpi	0.39***	0.36***	0.65***	0.32****	0.98***
	ir	0.003***	0.01***	0	0.001	-0.002***
	$\Delta stock$	0.04***	0.53***	0.01*	0.017***	0.007**
	Δhp	0.18***	-0.23***	0.11***	0.21***	0.05***
	Δm	-0.31***	-0.53***	0.09***	-0.12***	-0.03**
	Δc	0.19***	0.7***	-0.05**	-0.13***	0.006
	$cap\ share$	0.001	0.002***	-0.002***	-0.007***	-0.003***
ir	Δy	8.15***	0.39	18.1***	-7.14**	24.7***
	Δcpi	-7.13***	-5.25***	-3.57**	-7.68***	12.46***
	ir	0.93***	0.82***	0.88***	0.97***	0.79***
	$\Delta stock$	-4.44***	-0.19***	1.62***	3.12***	1.63***
	Δhp	13.65***	2.87***	-1.34*	-6.03***	3.51***
	Δm	1.5***	3.88***	-0.34	0.38	1.27
	Δc	7.66***	1.87***	3.27***	30.32***	0.06
	$cap\ share$	0.07***	0.005	-0.14***	0.03	-0.17***
$\Delta stock$	Δy	-1.89***	-0.79***	0.28	-2.39***	1.15**
	Δcpi	-1.89***	-0.46***	-1.65***	-1.15***	-4.06***
	ir	0.013***	0.003	0.003	-0.002	0.008
	$\Delta stock$	0.33***	0.87***	0.24***	-0.21***	0.24***
	Δhp	0.14***	0.12***	-0.34***	-0.65***	0.39**
	Δm	0.9***	0.46***	0.42***	2.35***	0.41*
	Δc	-0.14	-0.61***	-0.62***	0.17	-1.73***
	$cap\ share$	0.003	-0.004***	-0.02***	0.01***	-0.06***
Δhp	Δy	-0.48***	-0.51***	0.51***	-0.29**	-0.03
	Δcpi	-0.71***	-0.06***	-0.09	-0.09	-1.34***
	ir	0.002	0.016***	-0.004***	0.003**	0
	$\Delta stock$	0.09***	0.44***	0.05***	0.06***	0.05***
	Δhp	0.48***	0.09***	0.16***	-0.14***	0.72***
	Δm	0.39***	0.23***	-0.06	0.18***	0.48***
	Δc	0.32***	-0.6	0.22***	1.4***	-0.17**
	$cap\ share$	0.001	0.002***	-0.009***	0.005***	-0.01***

Δm	Δy	0.08**	-0.05	0.61***	-0.1*	0.93***
	Δcpi	0.23***	0.47***	0.51***	0.29***	0.72***
	ir	0.002***	0.002**	-0.003***	0.002***	-0.005***
	$\Delta stock$	0.03***	0.28***	0.006	-0.05***	0.005
	Δhp	0.09***	0.09**	-0.013	-0.19***	-0.2***
	Δm	0.38***	0.32***	0.36***	0.85***	-0.02
	Δc	-0.03	-0.29***	-0.08***	0.34***	0.35***
	$cap\ share$	0	0	-0.006***	0.004***	-0.006**
Δc	Δy	-0.05	0.31***	0.43***	-0.02	0.11
	Δcpi	-0.04	-0.01	0.04	-0.28***	-0.82***
	ir	0.002***	0.002*	-0.002**	-0.005***	0.002**
	$\Delta stock$	0.06***	0.28***	0.025***	0.01	0.05***
	Δhp	0.21***	0.21***	0.056**	0.13	0.14***
	Δm	0.6***	1.41***	0.43***	0.21***	0.19***
	Δc	0.14***	-0.86***	0.32***	0.39***	0.59***
	$cap\ share$	0.001	0	-0.004***	-0.009***	-0.006***
$cap\ share$	Δy	-2.38	-30.01***	-8.07***	-21.93***	15.77***
	Δcpi	-13.94***	-24.31***	-14.27***	-28.55***	-1.94
	ir	0.04**	0.12***	0.02	0.16***	-0.23***
	$\Delta stock$	0.56**	0.1***	1.91***	1.99***	1.08***
	Δhp	-7.09***	-3.65***	-1.84***	-6.6***	-9.67***
	Δm	6.02***	-0.32	-2.35***	-8.89***	-5.28***
	Δc	2.51**	12.87***	-0.42	17.83***	9.08***
	$cap\ share$	0.91***	0.97***	0.8***	0.74***	0.45***

Table 6: Granger causality

		(1)	(2)	(3)	(4)	(5)
dln_rgdpmad						
	dln_cpi	0.000	0.379	0.008	0.000	0.000
	stir	0.145	0.000	0.001	0.000	0.476
	dln_nomstock	0.000	0.000	0.000	0.362	0.000
	dln_house	0.546	0.000	0.017	0.000	0.000
	dln_money	0.003	0.079	0.000	0.000	0.003
	dln_tloans	0.000	0.002	0.000	0.000	0.000
	grosscap	0.460	0.000	0.000	0.000	0.000
	ALL	0.000	0.000	0.000	0.000	0.000
dln_cpi						
	dln_rgdpmad	0.000	0.000	0.000	0.000	0.000
	stir	0.000	0.000	0.279	0.363	0.000
	dln_nomstock	0.000	0.000	0.093	0.123	0.026
	dln_house	0.000	0.000	0.000	0.000	0.000
	dln_money	0.000	0.000	0.000	0.000	0.010
	dln_tloans	0.000	0.000	0.018	0.000	0.611
	grosscap	0.520	0.000	0.001	0.000	0.000
	ALL	0.000	0.000	0.000	0.000	0.000
stir						
	dln_rgdpmad	0.000	0.279	0.000	0.026	0.000
	dln_cpi	0.000	0.000	0.020	0.000	0.000
	dln_nomstock	0.000	0.023	0.000	0.000	0.000
	dln_house	0.000	0.000	0.074	0.000	0.001
	dln_money	0.000	0.000	0.717	0.729	0.372
	dln_tloans	0.000	0.000	0.002	0.000	0.966
	grosscap	0.001	0.122	0.000	0.338	0.002
	ALL	0.000	0.000	0.000	0.000	0.000
dln_nomstock						
	dln_rgdpmad	0.025	0.000	0.250	0.000	0.034
	dln_cpi	0.000	0.000	0.000	0.000	0.000
	stir	0.002	0.142	0.322	0.395	0.141
	dln_house	0.161	0.003	0.000	0.000	0.046
	dln_money	0.000	0.000	0.004	0.000	0.061
	dln_tloans	0.000	0.000	0.000	0.252	0.000
	grosscap	0.843	0.000	0.000	0.000	0.000
	ALL	0.000	0.000	0.000	0.000	0.000

dln_house						
	dln_rgdpmad	0.505	0.000	0.000	0.017	0.874
	dln_cpi	0.251	0.000	0.131	0.266	0.000
	stir	0.031	0.000	0.000	0.034	0.951
	dln_nomstock	0.000	0.000	0.000	0.001	0.000
	dln_money	0.000	0.000	0.170	0.000	0.001
	dln_tloans	0.000	0.196	0.000	0.000	0.037
	grosscap	0.110	0.000	0.000	0.001	0.000
	ALL	0.000	0.000	0.000	0.000	0.000
dln_money						
	dln_rgdpmad	0.000	0.526	0.000	0.084	0.000
	dln_cpi	0.000	0.000	0.000	0.000	0.000
	stir	0.000	0.043	0.000	0.004	0.000
	dln_nomstock	0.000	0.000	0.402	0.000	0.559
	dln_house	0.275	0.032	0.523	0.000	0.000
	dln_tloans	0.084	0.000	0.006	0.000	0.000
	grosscap	0.283	0.135	0.000	0.000	0.010
	ALL	0.000	0.000	0.000	0.000	0.000
dln_tloans						
	dln_rgdpmad	0.000	0.000	0.000	0.762	0.254
	dln_cpi	0.000	0.675	0.426	0.000	0.000
	stir	0.137	0.076	0.010	0.000	0.028
	dln_nomstock	0.000	0.000	0.004	0.345	0.000
	dln_house	0.000	0.000	0.033	0.000	0.000
	dln_money	0.000	0.000	0.000	0.000	0.005
	grosscap	0.480	0.196	0.000	0.000	0.003
	ALL	0.000	0.000	0.000	0.000	0.000
grosscap						
	dln_rgdpmad	0.216	0.000	0.000	0.000	0.000
	dln_cpi	0.000	0.000	0.000	0.000	0.638
	stir	0.100	0.000	0.272	0.000	0.000
	dln_nomstock	0.000	0.007	0.000	0.000	0.000
	dln_house	0.021	0.000	0.001	0.000	0.000
	dln_money	0.023	0.805	0.003	0.000	0.004
	dln_tloans	0.000	0.000	0.613	0.000	0.000
	ALL	0.000	0.000	0.000	0.00	0.000

Table 7: Panel-OLS model, Specification I

	(1)	(2)	(3)	(4)	(5)
	1875 -2013	1875 - 1930	1930 - 2013	1945 - 1980	1980 - 2013
Observations	1491	345	1159	471	544
Δy	-7.92 (5.41)	-4.69 (9.67)	4.83 (5.23)	-15.96 (17.78)	23.48** (9.2)
y gap	25.89*** (8.58)	29.45** (10.36)	7.83 (7.5)	42.54** (14.76)	8.52 (13.07)
stir	-0.26*** (0.08)	-0.25 (0.34)	-0.15* (0.08)	-0.35*** (0.12)	-0.19* (0.1)
Δcpi	2.05 (3.42)	4.16 (3.68)	-12.35*** (4.01)	-2.01 (4.9)	-14.12 (11.13)
Δm	-0.48 (6.31)	16.49** (5.49)	-4.71 (4.88)	-3.04 (5.53)	0.33 (2.85)
Δc	-8.41*** (2.85)	-3.20 (2.28)	-10.95** (4)	-3.34 (3.74)	-1.36 (4.03)
Open	4.21 (4.29)	22.21*** (5.45)	2.99 (3.52)	-5.19 (11.01)	5.47 (3.88)
Gov. exp.	-24.53*** (5.55)	-0.82 (5.35)	-14.27** (4.87)	-33.09*** (7.39)	-1.69 (8.38)

Table 8: Panel-OLS model, Specification II

	(1)	(2)	(3)	(4)	(5)
	1875 -2013	1875 - 1930	1930 - 2013	1945 - 1980	1980 - 2013
Observations	1262	241	1032	383	533
Δy	-10.52* (5.84)	-15.47 (14.21)	-3.53 (6.68)	-4.71 (10.46)	7.07 (7.85)
y gap	26.73*** (6.96)	39.52*** (11.15)	13.51** (5.43)	23.41 (14.01)	20.9** (9.83)
stir	-0.23*** (0.07)	0.15 (0.52)	-0.17** (0.08)	-0.32*** (0.1)	-0.19* (0.1)
Δcpi	3.99 (3.44)	0.65 (3.65)	-10.46* (5.4)	7.39 (4.33)	-29.01*** (9.11)
Δm	3.22 (5.7)	20.12** (8.26)	-2.31 (4.45)	-4.18 (5.27)	-1.84 (2.2)
Δc	-6.32** (2.83)	-7.62* (3.99)	-5.66* (3.09)	-1.93 (3.24)	0.03 (3.28)
Open	7.30** (2.65)	18.30** (7.62)	5.10** (2.28)	5.97* (3.19)	5.11 (3.76)
Gov. exp.	-25.34*** (5.81)	-2.50 (6.5)	-15.57** (5.32)	-34.91*** (8.18)	1.48 (7.59)
$\Delta stock$	2.63*** (0.82)	4.78 (3.47)	2.02** (0.78)	2.98*** (0.96)	0.63 (0.48)
L1($\Delta stock$)	2.47*** (0.68)	3.43* (1.71)	2.46*** (0.68)	2.11** (0.95)	0.58 (0.36)
L2($\Delta stock$)	2.06*** (0.57)	2.01 (2.01)	2.23*** (0.43)	1.45 (0.99)	0.42 (0.29)
$\Delta house$	-1.65 (1.46)	1.06 (2.26)	-2.71 (2.05)	-0.29 (1.77)	0.77 (1.76)
L1($\Delta house$)	-3.54*** (1.04)	-0.53 (2.53)	-2.78 (2.67)	-1.20 (1.98)	2.26* (1.17)
L2($\Delta house$)	-5.35*** (1.77)	1.00 (1.48)	-6.40** (2.96)	-3.64* (2.04)	-1.43 (1.86)

Table 9: Panel-OLS model, Specification III

	(1)	(2)	(3)	(4)	(5)
	1875 -2013	1875 - 1930	1930 - 2013	1945 - 1980	1980 - 2013
Observations	1277	253	1034	392	527
Δy	-10.08* (5.76)	-18.41 (13.3)	0.36 (6.5)	-6.71 (9.7)	10.20 (8.09)
y gap	32.57*** (7.43)	45.86*** (12.98)	20.96** (7.88)	36.11*** (10.95)	27.51** (10.81)
stir	-0.26*** (0.07)	0.18 (0.46)	-0.17* (0.09)	-0.34*** (0.1)	-0.17 (0.11)
Δcpi	4.90* (2.69)	-0.11 (3.33)	-11.54* (5.69)	7.25 (4.41)	-28.10*** (9.08)
Δm	2.77 (5.56)	23.33** (8)	-3.45 (4.45)	-6.38 (5.67)	-1.67 (2.24)
Δc	-6.95* (3.04)	-7.04* (3.85)	-7.71 (3.83)	-1.53 (3.71)	-1.10 (4.08)
Open	8.74*** (2.96)	16.75** (7.66)	6.62* (2.56)	6.63* (3.68)	6.09 (3.98)
Gov. exp.	-26.05*** (5.69)	-5.62 (7.02)	-15.54** (5.88)	-36.67*** (8.66)	2.05 (7.81)
$\Delta stock.$ mov. avg.	4.89*** (1.12)	7.55* (3.51)	3.30*** (1.02)	4.18** (2.13)	0.46 (0.85)
$\Delta house$ mov. avg.	-3.49 (2.65)	5.11 (3.54)	-4.45 (3.66)	0.52 (2.13)	2.89 (2.25)

Table 10: Panel-OLS model, Specification III

	(1)	(2)	(3)	(4)	(5)
	1875 -2013	1875 - 1930	1930 - 2013	1945 - 1980	1980 - 2013
Observations	1262	241	1032	383	533
Δy	-9.08 (5.75)	-12.22 (13.03)	0.38 (6.5)	-5.72 (10.21)	10.55 (7.29)
y gap	27.18*** (6.36)	41.27*** (10.03)	15.30** (5.7)	31.35** (11.78)	21.23** (9.32)
stir	-0.25*** (0.08)	-0.04 (0.48)	-0.16* (0.08)	-0.37*** (0.11)	-0.18 (0.1)
Δcpi	3.46 (2.85)	2.14 (3.81)	-16.38*** (4.97)	4.34 (3.41)	-29.02*** (8.98)
Δm	2.25 (5.82)	23.32** (9.26)	-4.35 (4.2)	-5.48 (6.02)	-1.60 (2.41)
Δc	-7.76** (3.19)	-5.55 (3.28)	-8.06* (3.95)	-2.56 (4.11)	1.35 (2.9)
Open	7.69** (3.19)	20.44** (7.71)	5.19** (2.35)	6.68* (3.35)	5.12 (3.69)
Gov. exp.	-24.20*** (5.56)	-4.20 (6.93)	-13.23** (5.68)	-34.10*** (8.33)	1.35 (7.36)
D1(Δstock)	0.20 (0.28)	0.84 (1.59)	-0.21 (0.31)	0.89* (0.45)	0.07 (0.28)
L(D1(Δstock))	0.72 (0.29)	1.40 (0.57)	0.40 (0.35)	1.05 (0.61)	0.04 (0.3)
D1(Δhouse)	3.30*** (0.93)	1.00 (2.25)	2.99** (1.08)	2.38* (1.3)	0.43 (1.38)
L(D1((Δhouse))	3.15** (1.57)	0.13 (1.94)	3.83*** (1.25)	2.83** (1.2)	2.39* (1.16)

Table 11: Panel-OLS model, Specification IV

	(1)	(2)	(3)	(4)	(5)
	1875 -2013	1875 - 1930	1930 - 2013	1945 - 1980	1980 - 2013
Observations	1289	254	1046	393	535
Δy	-9.12 (6.1)	-12.85 (12.02)	2.73 (6.33)	-2.68 (10.9)	14.42* (8.12)
y gap	25.65*** (7.89)	37.55*** (10.21)	8.37 (8.05)	27.68 (13.58)	17.75 (10.49)
stir	-0.22** (0.08)	0.03 (0.50	-0.14 (0.08)	-0.34*** (0.11)	-0.17 (0.11)
Δcpi	3.95 (2.86)	0.85 (3.76)	-14.06** (5.26)	4.14 (3.69)	-25.71** (9.55)
Δm	1.58 (5.88)	22.92** (9.04)	-4.84 (4.5)	-6.54 (6.15)	-1.44 (2.47)
Δc	-7.58** (2827)	-4.56 (3.5)	-9.70** (3.96)	-1.91 (4)	-0.05 (3.37)
Open	8.20** (2.97)	21.39** (7.09)	5.67** (2.46)	7.19** (3.5)	5.29 (3.89)
Gov. exp.	-24.47*** (5.49)	-3.36 (7.06)	-13.13** (6.02)	-33.40*** (8.54)	0.49 (7.86)
HP gap stock	2.59*** (0.74)	1.92 (3.28)	2.42*** (0.77)	2.93* (1.48)	0.89 (0.63)
L1(HP gap stock)	-0.31 (1.65)	-2.37 (2.2)	1.32** (0.58)	-1.47 (0.95)	0.33 (0.49)
HP gap house	-2.19 (1.96)	-4.83 (4.71)	1.63 (2.32)	4.07 (2.89)	0.63 (3.38)
L1(HP gap house)	-6.34*** (1.66)	-3.82 (4.01)	-4.70** (1.6)	-3.12 (2.37)	-1.35 (2.65)

Table 12: Panel-OLS model, Specification V

	(1)	(2)	(3)	(4)	(5)
	1875 -2013	1875 - 1930	1930 - 2013	1945 - 1980	1980 - 2013
Observations	1276	248	1039	388	534
Δy	-11.44* (6.07)	-15.16 (13.63)	-3.58 (6.27)	-7.13 (9.17)	8.83 (8.02)
y gap	27.58*** (7.12)	38.01*** (10.78)	14.24** (6.33)	29.13** (12.59)	21.07** (9.69)
stir	-0.25*** (0.08)	0.09 (0.53)	-0.17* (0.08)	-0.32*** (0.1)	-0.18 (0.1)
Δcpi	3.94 (3.14)	-0.50 (3.49)	-12.55** (4.97)	6.36 (3.81)	-29.05*** (8.77)
Δm	3.26 (5.72)	22.22** (8.2)	-3.8 (4.26)	-5.61 (5.5)	-1.57 (2.27)
Δc	-7.01* (3.33)	-7.09* (3.66)	-8.39** (3.71)	-1.96 (3.68)	-1.08 (3.73)
Open	7.59** (2.78)	17.39** (7.65)	5.29** (2.36)	6.33* (3.36)	5.42 (3.84)
Gov. exp.	-25.41*** (5.76)	-3.98 (6.37)	-15.17** (5.65)	-35.67*** (8.03)	2.02 (7.26)
Std. dev. $\Delta stock$	0.53*** (0.15)	1.01 (0.64)	0.38*** (0.19)	0.49** (0.18)	0.15 (0.08)
L1(Std. dev. $\Delta stock$)	0.53*** (0.15)	0.51* (0.27)	0.57*** (0.2)	0.36* (0.2)	0.14 (0.08)
Std. dev. $\Delta house$	-0.17 (0.22)	0.32 (0.33)	-0.6 (0.19)	-0.03 (0.18)	0.08 (0.18)
L1(Std. dev. $\Delta house$)	-0.37*** (0.12)	0.10 (0.23)	-0.21 (0.2)	-0.11 (0.19)	0.25 (0.16)

Table 13: Panel-OLS model: OECD data

	(1)	(2)	(3)	(4)	(5)	(6)
	1970 - 2013	1970 - 2013	1970 - 2013	1970 - 2013	1970 - 2013	1970 - 2013
Observations	728	700	689	700	704	703
Δy	24.48** (8.35)	11.83 (9.81)	10.79 (8.95)	17.13* (9.73)	16.52 (9.6)	10.36 (10.27)
y gap	5.02 (9.25)	-0.90 (8.21)	16.24 (10.07)	1.84 (8.93)	3.39 (8.05)	5.01 (8.61)
stir	0.09 (0.07)	0.05 (0.09)	0.09 (0.08)	0.09 (0.08)	0.10 (0.08)	0.06 (0.08)
Δcpi	-28.99*** (6.98)	-31.49*** (8.01)	-33.74*** (8.14)	-34.97*** (8.51)	-32.86*** (8.14)	-31.66*** (8.13)
Δm	2.04 (1.99)	1.54 (1.57)	0.75 (1.83)	1.76 (1.85)	0.88 (1.93)	1.27 (1.81)
Δc	-4.48 (3.61)	-6.15 (0.15)	-5.91 (4.05)	-3.02 (3.24)	-3.23 (3.27)	-4.65 (3.99)
Open	6.93** (6.93)	5.18* (2.92)	6.67* (3.16)	5.90* (3.09)	6.27* (3.32)	5.61* (3.04)
Gov. exp.	-11.46* (5.66)	-14.64** (5.45)	-12.01* (6.02)	-13.06** (5.4)	-12.16* (5.93)	-13.52 (5.7)
$\Delta stock$		1.50** (0.54)	-	-	-	-
L1($\Delta stock$)	-	1.40** (0.52)	-	-	-	-
L2($\Delta stock$)	-	1.23*** (0.25)	-	-	-	-
$\Delta house$	-	2.28* (1.26)	-	-	-	-
L1($\Delta house$)	-	1.35* (0.7)	-	-	-	-
L2($\Delta house$)	-	-0.72 (1.3)	-	-	-	-
$\Delta stock.$ mov. avg.	-	-	2.05** (0.8)	-	-	-
$\Delta house$ mov. avg.	-	-	5.07** (2.01)	-	-	-
L(D1($\Delta stock$))	-	-	-	0.08 (0.26)	-	-
D1($\Delta house$)	-	-	-	0.08 (0.82)	-	-
L(D1(($\Delta house$))	-	-	-	1.79*** (0.6)	-	-
HP gap stock	-	-	-	2.62*** (0.64)	0.98* (0.48)	-
L1(HP gap stock)	-	-	-	-	0.22 (0.47)	-
HP gap house	-	-	-	-	-0.32 (1.18)	-

L1(HP gap house)	-	-	-	-	-4.40*** (1.19)	
Std. dev. $\Delta stock$	-	-	-	-		0.28*** (0.09)
L1(Std. dev. $\Delta stock$)	-	-	-	-		0.29*** (0.09)
Std. dev. $\Delta house$	-	-	-	-	-	0.15 (0.12)
L1(Std. dev. $\Delta house$)	-	-	-	-	-	0.05 (0.1)

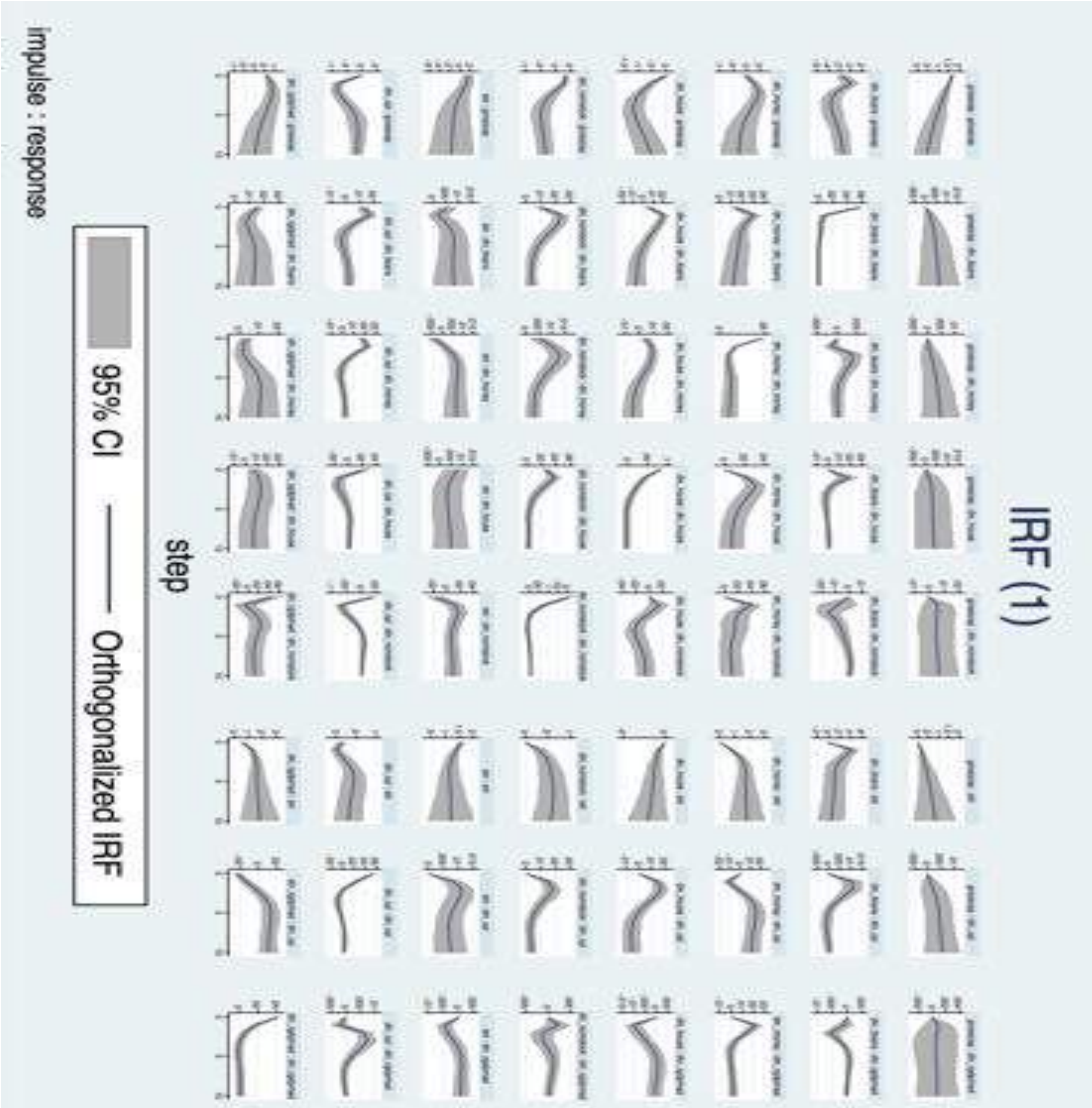
Table 14: Asset prices, summary statistics

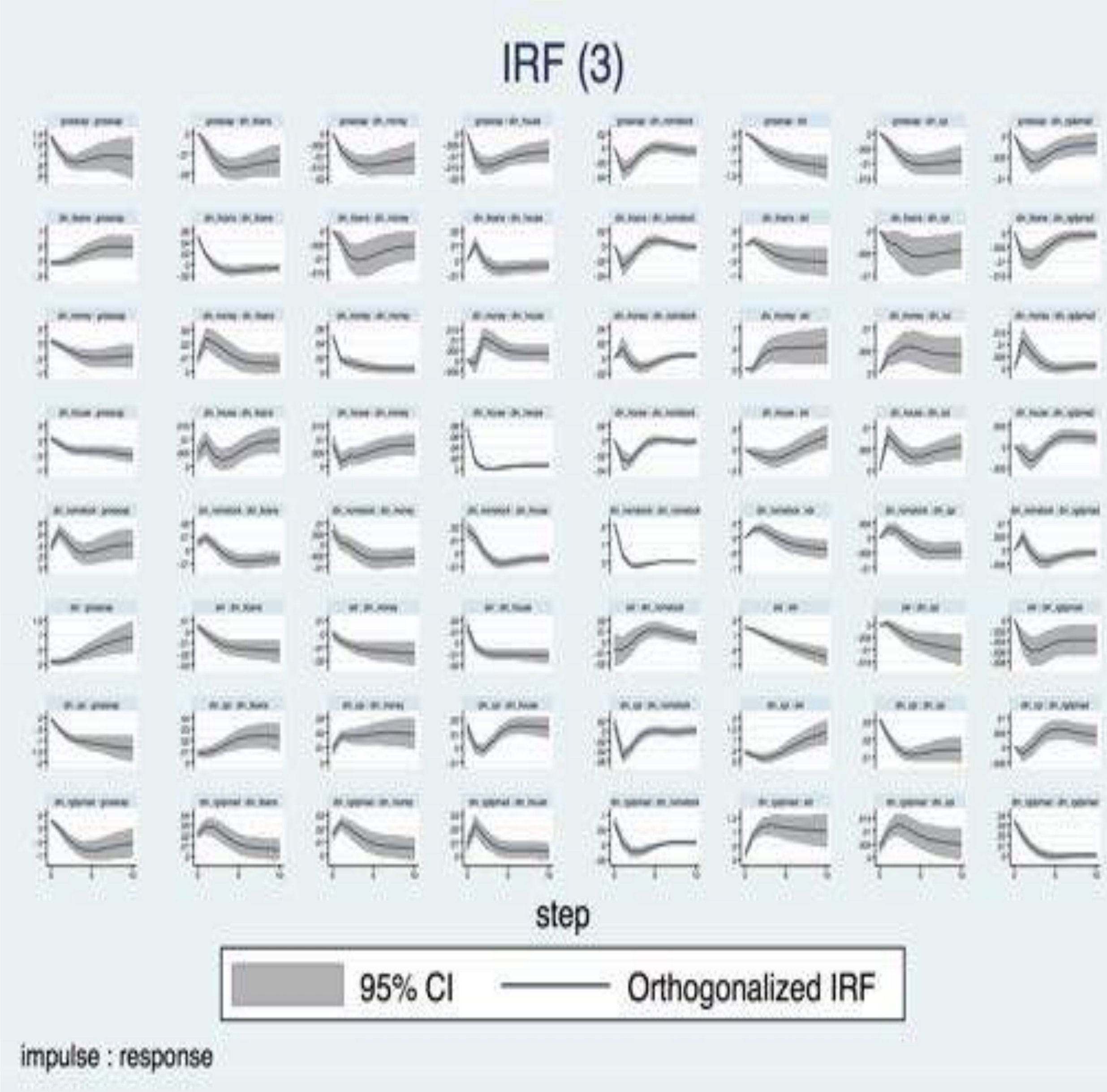
	Nominal stock price growth		Nominal house price growth	
Country	Mean	Standard deviation	Mean	Standard deviation
Australia	5,05%	14,94%	4,64%	10,08%
Belgium	3,15%	19,46%	4,93%	9,84%
Canada	4,58%	16,47%	5,00%	7,42%
Denmark	4,38%	15,44%	3,86%	7,54%
Finland	8,64%	24,16%	9,05%	17,11%
France	3,54%	16,35%	6,59%	8,28%
Germany	4,89%	27,17%	3,72%	10,95%
Italy	5,49%	26,19%	8,14%	12,58%
Japan	4,65%	25,44%	11,24%	21,21%
Netherlands	2,81%	16,99%	3,13%	9,15%
Norway	4,89%	19,18%	4,17%	8,43%
Portugal	5,34%	37,44%	3,13%	6,13%
Spain	3,25%	16,62%	9,28%	11,13%
Switzerland	4,68%	16,63%	3,65%	7,57%
Sweden	4,17%	17,33%	3,14%	5,58%
UK	4,01%	16,60%	4,80%	9,42%
USA	4,19%	18,13%	3,42%	7,54%

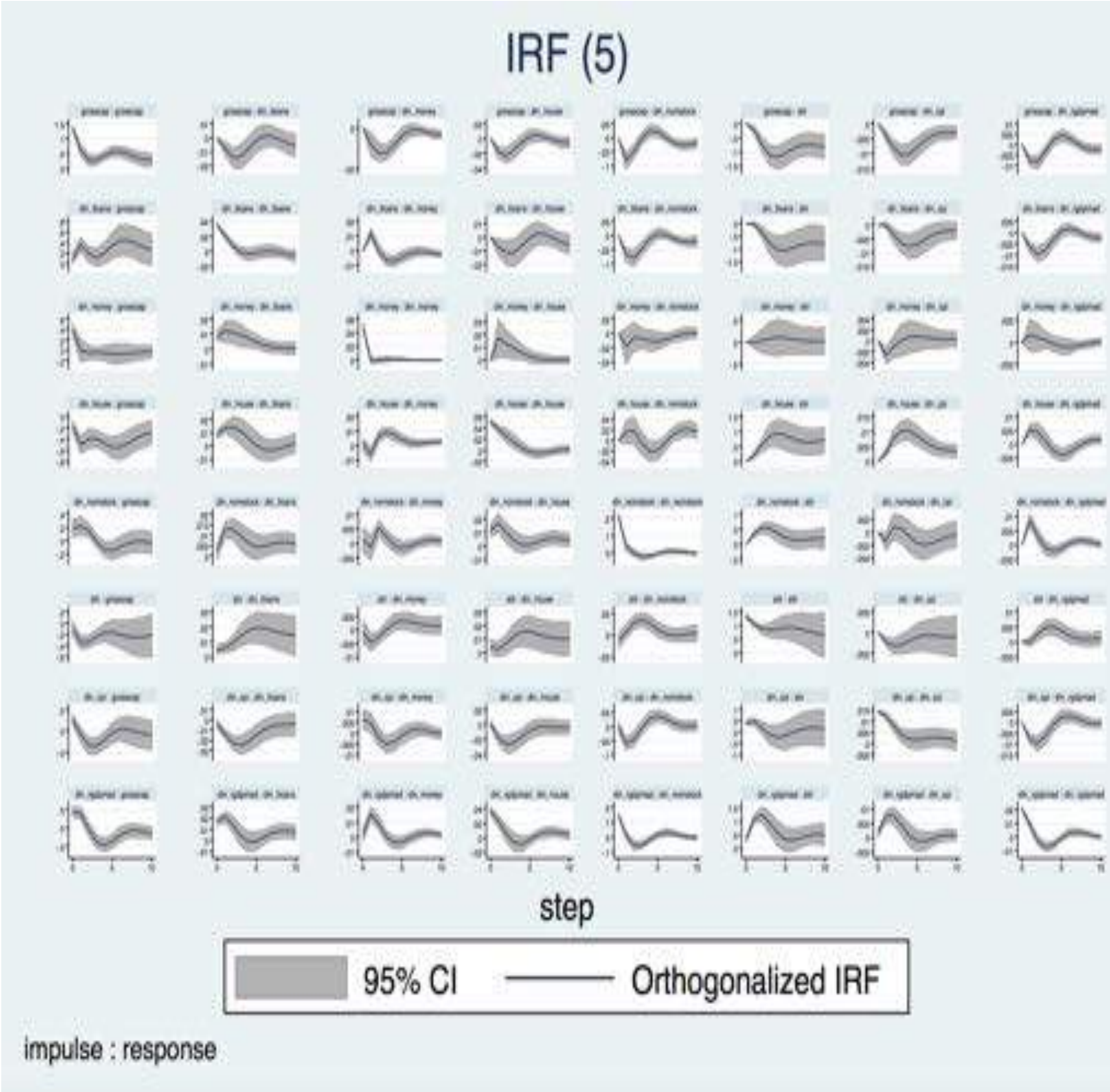
Table 15: Correlations capital share and top income shares

|	grosscap	netcap	OECDcapshare	top 0.1%	top 1%	top 10%
grosscap	1.0000					
netcap	0.9114	1.0000				
OECDcapshare	0.4641	0.3414	1.0000			
top01	0.4250	0.5352	0.0838	1.0000		
top1	0.1072	0.1562	0.2801	0.4394	1.0000	
top10	0.3603	0.5083	-0.1161	0.6151	-0.2737	1.0000

Impulse response functions for Estimations (1), (3), and (5):




IRF (3)
step
95% CI
Orthogonalized IRF
impulse : response


IRF (5)
step
95% CI
Orthogonalized IRF
impulse : response