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The Determinants of Wealth Inequality in the UK, USA and France

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Abstract

This paper analyses the determinants of wealth inequality, measured as the share of wealth owned by the top 1% wealthiest individuals in the UK, the USA and France, using structural vector autoregression (SVAR) models for the periods of 1919-2014 and 1970-2014. We analyse the impact of technological change, globalisation, top marginal income and inheritance tax rates, labour's bargaining power, privatisation and homeownership on wealth inequality. Our results indicate that the only robust and significant determinant across all three countries is the bargaining power of labour – measured by union density in the UK and USA and collective bargaining coverage in France. We find that privatisation does significantly lead to higher top 1% wealth shares in the UK and France, although in the USA the effect is insignificant. Top marginal income tax rates lead to a decline in top wealth shares in the UK but are insignificant in the USA and France.

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1. INTRODUCTION

The aim of this paper is to analyse what determines the recent rise in wealth inequality, measured as the share of the top 1% wealthiest individuals in total wealth. We analyse both the components of wealth inequality measured by differences in rates of return to wealth, saving rates, inheritance flows and income inequality, as well as the deep determinants of inequality driven by globalisation, technological change and institutional changes in industrial relations, taxation, homeownership rates and privatisation.

We address three gaps in the literature. Firstly, regarding the components, we present a cross country empirical analysis to the ongoing debate as to whether wealth inequality results from higher rates of return to wealth for the top 1% or from other factors driving incomes and savings. On the one hand, Kuhn et al. (2019) argue that wealth inequality since the 1970s in the USA is determined by the differences in the rates of return to wealth reflected by a race between the return to stocks, which are held by the wealthiest households, and housing, which is held by the middle of the distribution. De Nardi and Fella (2017) present a review of general equilibrium models which argue that differential rates of return are necessary to produce the high top 1% wealth shares observed in the data. On the other hand, Saez and Zucman, (2016:563) and Mian et al. (2020:25) argue that since the 1970s, an increase in the share of income going to the top 1% wealthiest households and differential saving rates in the USA are the key components driving wealth inequality. Lieberknecht and Vermeulen (2018) find similar results for France.

We contribute to this literature by estimating the impact of differential rate of returns and top 1% income shares on wealth inequality using structural vector autoregression (SVAR) models for the period of 1919-2014 for three countries for which long-term time series data are available, the UK, the USA, and France, extending the empirical analysis beyond the focus on the USA.[1] While we find that differential rates of return do increase wealth inequality in the USA, consistent with the literature above, this result does not hold for UK and France, where the effect is statistically insignificant. On the other hand, we find that a positive shock to top 1% income shares significantly leads to an increase in wealth inequality in all three countries.

Secondly, the existing literature on wealth inequality has largely ignored what we refer to as the deep determinants of wealth inequality. One exception is Piketty (2014) who discusses the role of technological and institutional changes on wealth inequality, albeit based on a largely descriptive rather than econometric analysis. This is in stark contrast to the literature on the causes of income inequality, where the relative importance of technological change, globalisation, labour's bargaining power and taxation have been extensively analysed. Given that we find that the top 1% income share is a robust determinant of wealth inequality, the second contribution of this paper is to synthesize these two strands of research on inequalities in income and wealth and empirically estimate whether the determinants of *income* inequality also impact *wealth* inequality. To the best of our knowledge this is the first paper to empirically estimate these deep determinants of the top 1% share of wealth across the three countries.

Our key result is that direct measures of the bargaining power of labour, measured by union density and collective bargaining coverage, are the only robust determinants of wealth inequality across all three countries and across all specifications. In the UK and the USA, we use union density as the indicator of labour's bargaining power given their decentralised

[1] To the best of our knowledge there is no analysis on the causes of wealth inequality in the UK -a country showing similar trends to the USA. The sample period in some estimations start at 1970 due to data availability for some explanatory variables.

bargaining regimes. In France however, due to its centralised bargaining regime, we use collective bargaining coverage to capture bargaining power. Quantitatively, shocks to labour's bargaining power explain 42%, 11% and 32% of the variation in top wealth shares in the UK, the USA and France respectively.

Thirdly, we also address two further deep determinants that primarily relate to wealth rather than income inequality, namely homeownership rates and the privatisation of public assets. While we find that homeownership rates do not have a significant impact on the top 1% wealth share in any country, we find that privatisation does significantly lead to higher top 1% wealth shares in the UK and France, although in the USA the effect is insignificant. We argue that this cross-country difference could be explained via differences in the impact public spending has on the bargaining power of labour, due to the different composition of public spending in the USA versus the UK and France. Top marginal income tax rates lead to a decline in top wealth shares in the UK but are insignificant in the USA and France, and we failed to find a significant effect of top marginal inheritance tax rates in any of the countries.

The rest of the paper is organised as follows: Section two provides a theoretical overview of the components of wealth inequality and how they relate to the deep determinants discussed above. Sections three and four discuss the data and estimation methodology. Section five presents the estimation results and section six concludes.

2. THEORETICAL FRAMEWORK

We first derive the components of the top 1% wealth share from an accounting framework before discussing the deep determinants and the relationship between the two. Building on the accounting framework used by several papers (Saez and Zucman, 2016; Kuhn, Schularick and Steins, 2018; Lieberknecht and Vermeulen, 2018; Smith *et al.*, 2019; Mian, Straub and Sufi, 2020) wealth W_{t+1}^f of fractile f (e.g. the top 1% wealthiest households) in period $t+1$ is given by:

$$W_t^f = W_{t-1}^f + s_t^f Y_t^f + h_t^f \quad (1)$$

where Y_t^f is pre-tax personal income, s_t^f is the saving rate and h_t^f is the net inheritances, gifts and inter vivos transfers for fractile f. These refer to synthetic rather than actual values, as it does not account for the fact that over time the top 1% is made up of different individuals entering and leaving the group.[2]

Personal income for fractile f is the sum of capital income $Y_{C,t}^f$ and labour income $Y_{L,t}^f$ where capital income is given by the product of previously accumulated wealth and the rate of return on wealth as shown below:

$$Y_t^f = Y_{C,t}^f + Y_{L,t}^f \quad (2)$$

$$Y_{C,t}^f = W_{t-1}^f r_t^f \quad (3)$$

[2] The approach of (Saez and Zucman, 2016; Kuhn, Schularick and Steins, 2018) is therefore to think of the saving and rate of return for fractile f as synthetic rates, which will approximate the actual average rates of the top 1% so long as the households entering and exiting are relatively similar to each other.

The rate of return on wealth, r_t^f is given by:

$$r_t^f = \sum_{j=1}^{J} \left(\frac{P_{j,t} - P_{j,t-1}}{P_{j,t-1}} + i_{j,t}\right) \frac{A_{j,t-1}^f}{W_{t-1}^f} \tag{4}$$

where $\frac{P_{j,t}-P_{j,t-1}}{P_{j,t-1}}$ is the proportionate change in the real price of asset j (deflated by the consumer price index); $i_{j,t}$is the yield rate of return for asset j; and $\frac{A_{j,t-1}^f}{W_{t-1}^f}$ is the share of asset $A_{j,t-1}^f$ in total wealth owned by fractile f in the previous period. We assume that capital income is earned on the wealth accumulated in the previous year.

As we have seen, a key debate in the literature is whether wealth inequality is determined by a race between the stock market and the housing market or by other shocks to income inequality. Given that we do not have data on $\frac{A_{j,t}^f}{W_t^f}$ for all the countries in our estimation and we only have long run data on the returns of housing and equities, we simplify the analysis by making three assumptions. Firstly, we assume that there are only two assets in the economy - equities and housing. Secondly, we assume that over time the composition of assets held by fractile f changes in line with the population as a whole.[3] Lastly, we assume that the top 1% hold all their wealth in stocks, while the population as a whole on average hold all of their wealth in housing. From these simplifying assumptions, it follows that:

$$r_t^f \approx \left(\frac{P_{stocks,t} - P_{stocks,t-1}}{P_{stocks,t-1}} + i_{stocks,t}\right) \tag{5}$$

and the rate of return on wealth for the population on aggregate r_t is given by the following equation.

$$r_t \approx \left(\frac{P_{housing,t} - P_{housing,t-1}}{P_{housing,t-1}} + i_{housing,t}\right) \tag{6}$$

Lastly, we integrate both inheritance and income taxes into the model. We first decompose the saving rate into the saving rate out of post-tax income $s_{post,t}^f$ and average income tax rate across all income sources T_y^f for fractile f.

$$s_t^f = s_{post,t}^f - T_y^f \tag{7}$$

[3] In other words, $\frac{A_{j,t}^f}{W_t^f} - \frac{A_{j,t+i}^f}{W_{t+i}^f} = \frac{A_{j,t}}{W_t} - \frac{A_{j,t+i}}{W_{t+i}}$. Taking data from the UK, this assumption is relatively justified. Between 2015 and 1971, the aggregate share of housing assets as a percentage of total net personal wealth has gone up from 42% to 70%. For the wealthiest 1%, housing share has gone from making up 10% of wealth to 30% of wealth over the same period.

We then decompose net inheritance, gifts and inter vivos transfers into the post-tax net transfers ${h_{post}}_t^f$ and average inheritance tax rate across all transfers T_h^f for fractile f.

$$h_t^f = h_{post,t}^f\left(1 - T_h^f\right) \tag{8}$$

Rearranging, we can write the law of motion for top wealth shares i.e. the ratio of wealth held by the top 1% of the wealth distribution to the rest of the population as

$$\frac{W_{t+1}^f}{W_{t+1}} = \frac{\frac{W_{t-1}^f}{W_{t-1}}\left(1 + s_t^f r_t^f\right) + s_t^f \frac{Y_t}{W_t}\frac{{Y_{L,t}}^f}{Y_t} + \frac{h_t^f}{Wt}}{1 + s_t r_t + \frac{s_t Y_{L_t}}{W_t}} \tag{9}$$

Equation 9 shows that top wealth shares in period $t+1$ is a positive function of $\frac{{Y_{L,t}}^f}{Y_t}$, r_t^f, s_t^f, $\frac{Y_t}{W_t}$, $\frac{Y_{L_t}}{W_t}$, $\frac{h_t^f}{W_t}$ $\frac{W_{t-1}^f}{W_t - 1}$ and is a negative function of $r_t, and s_t$. We focus on the four main factors.

A positive shock to differential rates of return $(r_t^f - r_t)$, all else being equal, leads to an increase in top wealth shares. The mechanism is through its impact on the capital income share $\frac{{Y_{C,t}}^f}{Y_t}$ and therefore personal income inequality $\frac{Y_t^f}{Y_t}$. All else being equal, a positive shock to differential rate of returns increase the top 1% share of personal income (*differential rate of return channel*).[4]

A positive shock to the share of labour income going to the top 1% $\frac{Y_{L,t}^f}{Y_t}$, all else being equal, leads to an increase in top wealth shares as the wealthiest households earn more labour income and increase their top 1% share of personal income (*personal income inequality channel*).[5]

A positive shock to differential saving rates $(s_t^f - s_t)$, all else being equal, increases the top 1% share of wealth. As shown in equation 7, differential saving rates are a positive function of differential saving rates out of post-tax income and a negative function of progressive income taxes[6] (*differential saving rate channel*).

Lastly, a positive shock to top 1% net inheritance, transfer and inter vivos flows as a ratio to aggregate wealth $\frac{h_t^f}{W_t}$ leads to an increase in the top 1% wealth share. As shown in

[4] On the other hand, the impact of a shock to the capital share of income on wealth inequality is ambiguous and depends on who is losing labour income and who is gaining capital income as can be seen in equation 5. If an increase in the capital share of income leads to a rise in $Y_{C,t}^f$ that is in absolute terms greater than a decline in $Y_{L,t}^f$, personal income inequality will increase, and all else being equal, so will wealth inequality. If an increase in the capital share of income leads to a decline in $Y_{L,t}^f$ that is in absolute terms greater than the rise in $Y_{C,t}^f$, then both personal income inequality and wealth inequality will decline. Lastly, an increase in the capital share of income that might not impact $Y_{C,t}^f$ or $Y_{L,t}^f$ at all, i.e. is only due to redistribution between capital and labour income within the 99%, has no impact on the top 1% share of personal income or the top 1% share of wealth.

[5] The personal income inequality channel also includes any changes due to capital income inequality, part of which will be captured by differential rate of returns.

[6] From equation 7, $s_t^f - s_t = (s_{post,t}^f - s_{post,t}) - (T_y^f - T)$ where $T_y^f - T$ is the difference in average tax rate of fractile f and the average tax rate of the whole economy. The greater $(T_y^{1\%} - T)$ the more progressive the income tax system.

equation 8, net inheritance, transfer and inter vivos flows are a positive function of post-tax flows and a negative function of progressive inheritance taxes (*top 1% inheritance channel*).

How do the deep determinants of inequality driven by globalisation, technological change and institutional changes relate to this framework? The contemporaneous causal relationships between the deep determinants and components of wealth inequality are summarised in Figure 1 below. Firstly, technological change leads to an increase in top 1% income shares through either labour-saving automation which increases the capital share of income or skill biased automation which increases wage inequality (*labour saving and skill biased automation channel*) (Berman, Bound and Griliches, 1994; Berman, Bound and Machin, 1998; Bentolila and Saint-Paul, 2003; Goldin and Katz, 2007; Autor, Katz and Kearney, 2008; Acemoglu and Autor, 2011; Bassanini and Manfredi, 2014; Goos, Manning and Salomons, 2014; Autor, 2015). Financial and trade globalisation also increases income inequality through similar channels, with the additional effect of offshoring (*offshoring channel*).

Labour market institutions, most notably trade unions and collective bargaining coverage, impact income inequality by increasing the bargaining power of labour vis a vis capital and/or managers (*bargaining channel*) (Ahlquist, 2017; Freeman and Medoff, 1985; Levy and Temin, 2007; Rosenfeld, 2014).[7] Stronger labour market institutions can lower the capital share of income directly and lower wage inequality through reducing top managerial pay, in addition to influencing public policy and fairness norms around pay and renumeration (Daudey and Decreuse, 2006; Kristal, 2010; Stockhammer, 2017; Fichtenbaum, 2009; Kristal, 2013; Stockhammer, 2009; Guschanski and Onaran, 2021; Frydman and Jenter, 201;0 McCall and Percheski; 2010). Trade and financial globalisation also impact income inequality by reducing the bargaining power of labour vis a vis capital by opening up the possibility to automate or offshore jobs in sectors that are historically the most unionised, such as manufacturing (Rodrik, 1998; Jayadev, 2007; McMillan and Harrison, 2007).

Technological change, globalisation and labour's bargaining power are also likely to impact differential rate of returns, as the return to equities are more responsive to automation and cross border financial flows, than housing returns which are not directly related to the sphere of production and tend to be more domestically focused (*production channel*).

Technological change, globalisation and labour's bargaining power also impact top 1% wealth shares via their impact on differential saving rates. An increase in financial assets, spurred on by technological change and globalisation, are increasingly held as assets by the top 1% and liabilities by the rest of society, leading to a relative rise in the savings by the top 1% of the wealth distribution (*financial-saving channel*) (Mian, Straub and Sufi, 2020). However, technological change and globalisation may also have an opposite impact on differential saving rates, as they decrease the price of consumer goods, and therefore the average savings relative to the top 1% (*consumer price channel*). Moreover, labour unions and collective bargaining coverage are expected to decrease differential saving rates by increasing or protecting the private pensions of workers (*pension channel*) (Ebbinghaus, 2017).

An increase in top marginal income tax rates decrease income inequality through three channels (Piketty et al, 2014): by decreasing the economic activity among the highest earners (*supply-side channel*); increasing the incentive to avoid tax and therefore decreasing declared incomes (*measurement error channel*) or by decreasing the rents extracted by high earners

[7] There is a large literature on how unions impact the dispersion of wages within the 99% which is less important for our analysis. See Farber *et al.* (2018) for an overview.

(*bargaining channel*). An increase in top marginal income tax rates also decrease differential saving rates, as it reduces the post-tax income of the top 1% (*progressive income tax channel*). An increase in top marginal inheritance tax rates on the other hand reduces wealth inequality by decreasing the net inheritance and inter vivos transfers to the top 1% as a ratio of aggregate wealth (*progressive inheritance tax channel*).

Homeownership rates impact top wealth shares via differential rate of returns by increasing the proportion of housing in aggregate wealth[8] and therefore increasing the capital gains and rents to the holders of housing wealth, who tend to be in the bottom 99% (*composition channel*) (Atkinson *et al.*, 1978; Anderson, 1992; Hancock, 1998; Henley, 1998; Hamnett, 2003; Bonnet and Bono, 2014; Rognlie, 2015; Fuller, Johnston and Regan, 2019; Pfeffer and Waitkus, 2019). An increase in homeownership rates also leads to higher average savings relative to the top 1%, and therefore lower wealth inequality, as households in the middle of the wealth distribution are more likely to increase their savings rate to get on the housing ladder (*homeowner saving channel*).

The privatisation of public assets have competing effects on wealth inequality (Fessler and Schürz, 2015). A decline in public wealth may lead to lower wealth inequality via decreasing differential saving rates, as the bottom 99% save more due to a declining social safety net and the need to hold private wealth for precautionary reasons *(precautionary saving channel*). A decline in public wealth, however, may lead to higher wealth inequality if the top 1% gain windfall financial returns on the newly privatised assets (*privatisation windfall channel*). Lastly, a decline in public wealth may increase wealth inequality as less public wealth leads to a decline in labour's social wage and thereby bargaining power, as workers have lower outside options (*bargaining channel*).

Lastly, income and wealth inequality can influence all the other variables in the system via a political channel, as economic wealth can be transformed into political power to shape the policies and norms in society towards the interests of the top 1%. Below we argue that this is not likely to occur contemporaneously, as it takes time for economic power to be turned into effective policy change.

Place Figure 1 here

3. DATA

Table A1 and Table A2 in the online appendix present the variable definitions, data sources and summary statistics for the components and deep determinants of wealth inequality respectively. Both the share of net personal wealth held by the top wealthiest 1% of individuals and the share of pre-tax national income of the top 1% of the income distribution are based on data provided by the World Inequality Database (WID).[9] The data on differential rate of returns (the real rate of return for stocks minus that for housing) comes from the Macro History Database (Jordà et al, 2019). The real rate of return for each asset is measured as the sum of

[8] In the discussion above we assumed that there was no change in the composition of wealth between the top 1% and the bottom 99%. Here we test this directly by controlling for changes in the homeownership rate, as a proxy for the change composition of wealth held by the bottom 99%. We focus on homeownership rates to link to the literature on whether extending homeownership impacts wealth inequality.

[9] This is the share of income going to the top 1% of the income distribution, rather than the top of the wealth distribution, as we do not have long run data on the latter variable. As Kuhn et al (2018, p. 53) shows the two distributions follow the same trend over time for the USA; we therefore follow the literature (Saez and Zucman, 2016; Lieberknecht and Vermeulen, 2018) and use the top 1% share of the income distribution as a proxy.

the asset price inflation and yield return for each asset, deflated by the consumer price index. We do not have data for differential saving rates or inheritance flows to the top 1%; these components are captured by the direct shocks to wealth inequality as discussed below.

Regarding the deep determinants, technological change is measured as the aggregate real ICT capital stock as a ratio to real value added based on data provided by the EU KLEMS for the period of 1970-2015. This variable has been used to capture both labour saving and skills biased technological in the literature on the determinants of capital income shares (Bassanini and Manfredi, 2014; Guschanski and Onaran, 2020; Michaels et al., 2014; Stockhammer, 2017).

Globalisation is captured using both the KOF de jure measure of financial and trade globalisation (Gygli *et al.*, 2019). We focus primarily on financial globalisation as this is expected to have a more direct impact on financial assets, returns and wealth than trade. This is a composite index built from laws on investment restrictions, capital account openness, international investment agreements and international voice traffic. We prefer de jure measures as these, being policy variables, tend to be the most exogenous. We test the robustness of our results using other KOF indices of globalization.

Regarding the direct measures of labour's bargaining power, we use different variables for decentralised bargaining systems in the UK and USA versus the coordinated bargaining system in France based on the industrial relations literature (Jensen, 2006). In a decentralised system, wages are negotiated at the firm or company level (Ferreiro, 2004). In a coordinated or centralised system, bargaining over wages is coordinated at the sectoral or national level (Nikolka and Poutvaara, 2018). In the UK and USA, the bargaining power of labour depends on the power they have at the firm or company level and is therefore directly tied to whether they are unionised at the firm level. In a coordinated or centralised system, the state takes a more active role in regulating labour market conditions and industrial relations and collective bargaining coverage may be substantially higher than union density (Ebbinghaus and Visser, 2001: 238). Therefore, the bargaining power of labour depends on the extent to which they are covered by the negotiations and regulations coordinated at the state level, for which collective bargaining coverage is a better measure. France, despite having one of the lowest union density rates in the OECD has a very high collective bargaining coverage and is widely considered to have more favourable industrial relations for labour. Therefore, union density in France does not capture the extent of labour's bargaining power (Guschanski and Onaran, 2020).

The effects of progressive taxation is measured by both the top marginal inheritance tax rate and the top marginal income tax rate, both of which are provided by WID.

Public wealth is measured by the net wealth of the public sector as a ratio to net national income (Piketty & Zucman, 2014; Estevez-Bauluz, 2017). Net public wealth is the total value of assets (cash, housing, bonds, equities, etc.) owned by the general government sector (central government, state government, local government, and social security funds) minus its debts.

Lastly, homeownership rates measure the percentage of all households that are owner occupied.

4. ESTIMATION METHODOLOGY

Our empirical methodology takes a two-step process. We first estimate the impact of the components of wealth on the top 1% wealth share (Model I). After finding that the top 1% income share is a significant determinant of wealth inequality, we then estimate the impact of

the deep determinants on the top 1% wealth share and income share. We do this to analyse whether the deep determinants have a direct impact on wealth inequality or whether they are impacting wealth via the income distribution. We estimate three different specifications for Model II, including top inheritance tax rates (Model IIA), public wealth (Model IIB) and homeownership rates (Model IIC) alternatively.

We estimate both models using a SVAR for each country, for three reasons. Firstly, unlike an ARDL, the SVAR approach models the feedback effects of income inequality and wealth inequality on the deep determinants in addition to the interlocking relationships between the components and deep determinants. Secondly, we do not have a sufficient number of countries to estimate a panel data model as long-term time series data for wealth distribution exists only for the UK, the USA and France. Lastly, rather than finding average effects across the three countries in a panel SVAR, the small number of countries makes it possible to explicitly compare cross country differences in the estimated parameters.

According to Kilian and Lütkepohl (2017:196), "the central objective in structural VAR analysis is to quantify causal relationships in the data." We do this by imposing short-run restrictions via a Cholesky Decomposition to identify mutually uncorrelated shocks. We can write the data generating process according to the following structural equation:[10]

$$B_0\boldsymbol{y_t} = B_1 + B_2\boldsymbol{y_{t-1}} + B_3\boldsymbol{y_{t-2}} + C\boldsymbol{u_t}$$

where $\boldsymbol{y_t}$ is a K x 1 vector of a set of determinants; B_i are the model coefficients, $i = 0, \dots, p$ which are interpreted in the same way as any normal OLS regressions coefficient;[11] and $\boldsymbol{u_t}$ is a K x 1 vector of structural shocks. Below we present $\boldsymbol{e_t} = B_0^{-1}\boldsymbol{u_t}$ for each model, where $\boldsymbol{e_t}$ are the reduced-form errors for the underlying VAR and B_0^{-1} denotes the contemporaneous relationships between the variables.

Theoretically, a Cholesky Decomposition imposes both a lower triangular matrix on B_0 and leaves the diagonal of C unrestricted in addition to restricting its off-diagonal elements to zero. Intuitively, this assumes that if a variable is ordered above another in the system, the variable above has a contemporaneous impact on all variables below without any contemporaneous feedback effects on it, i.e. the variables ordered above are contemporaneously exogenous to those below. We assume that the deep determinants of wealth are contemporaneously exogenous to wealth inequality and its components. This is because the channel through which wealth and income inequality influence technological change, industrial relations, taxes etc, is via a political channel that takes longer than a year to materialise. Economic wealth does not instantly create political power, as campaigns to influence public opinion or lobbying to change laws takes time to materialise effectively. The feedback effects should therefore only occur with a lag.

Regarding the relationship between the deep determinants themselves, as there is no theoretically justified ordering of the deep determinants, we follow the literature and report every possible ordering (Kloßner and Wagner, 2013; Henly and Wolman, 2011; Diebold and Yilmaz, 2009). Our baseline specification assumes that de jure globalisation and tax rates are

[10] As discussed in (Kilian and Lütkepohl, 2017, p. 219) there are three alternative representations of the SVAR model. We use what is commonly referred to as the AB model (the most general model). The alternative representations are to set C equal to the identity matrix (commonly referred to as the A model), or B_0 equal to the identity matrix (commonly referred to as the B model).

[11] B_2 gives the partial effect of a one-unit shock of a lagged variable in vector y_{t-1} on a dependent variable in vector y_t.

the most exogenous variables as these are slow moving policy variables. The orderings of the variables for each model are shown via the identification matrices in Figure 2 and 3.[12]

Place Figure 2 here
Place Figure 3 here

These models are derived directly from the theoretical framework and the model coefficients b_1, b_2 etc capture specific subsets of the causal channels highlighted in Figure 1. For example, in Model I, b_1 captures the contemporaneous impact of differential rate of returns on the top 1% share of income (arrow 1 in Figure 1).

Moreover, we use the theoretical framework to meaningfully interpret the contemporaneous shocks of wealth inequality on itself, i.e. the last shocks in each model. In Model I, as we have data for personal income inequality and differential rates of return, the remaining components of wealth inequality - differential saving rates and top 1% net inheritance – are therefore captured by $u_{2t}^{diff\ saving\ \&\ inheritance\ shock}$. In Model IIA, this changes to $u_{5t}^{other\ diff\ saving\ \&\ inheritance\ shock}$ as the deep determinants capture some of the effects of these components. The term 'other' therefore refers to the remaining shocks that are not caused by the deep determinants.

In section 5 below on the estimation results, we present both orthogonalized structural impulse response functions (OIRF) and forecast error variance decompositions (FEVD). The OIRF plot the response of top wealth shares over time to a 1%-point increase in each determinant or component. The FEVD shows how much of the unconditional variance in top wealth shares is explained by each determinant or component over time.

We estimate the SVAR models in levels with an intercept. Even if some of the variables are integrated of order one or potentially cointegrated, estimating an SVAR in levels with an intercept remains consistent, while imposing unit roots and/or cointegration restrictions when they do not actually hold leads to inconsistent estimates (Kilian and Lütkepohl, 2017:373).

We present 95% confidence interval bands, using conventional residual-based bootstrap confidence intervals, which are more accurate in small samples than the standard asymptotic confidence intervals (Kilian and Lütkepohl, 2017:340). We include two lags in both models based on information criteria and autocorrelation tests, which are presented in Tables A3 and A4 in the online appendix. The models satisfy the eigenvalue stability condition and normality tests at the 1% significance level.

Finally, we only analyse the results up to 11 years after the shock for both the OIRF and FEVD to keep the bootstrap inference valid (Kilian and Lütkepohl, 2017:377).

5. ESTIMATION RESULTS

We first present the estimation results for the impact of the components of wealth on the top 1% wealth share based on Model I. We then report the effects of the deep determinants on top wealth shares.

5.2. The effects of the components of wealth on the top 1% wealth share

[12] The identification matrices for Model IIB-C are presented in Figure A1 in the appendix. The identification matrices for all the robustness tests are presented in Figure A2.

Figure 4 shows the effect of each component on the top 1% wealth share. These models are estimated for a common estimation period of 1919-2014 determined by data availability for all countries.

We find that the top 1% income share has a statistically significant effect across all three countries.[13] A one %-point shock to the top income share leads to an increase in the top wealth share by 0.8 to 1.4 %-points after 10 years. On the other hand, shocks to differential rates of return only have a statistically significant effect on top wealth shares in the USA. Lastly, shocks to differential saving rates and top 1% inheritances have a statistically significant effect on wealth inequality across all three countries.

The relative importance of each of these shocks are shown in the FEVD in Table 1 below. In all three countries, in the first 5 years, the variation in top wealth shares is largely explained by differential saving rate and top inheritance effects. However, after 5 years, shocks to income inequality play an increasingly important role, explaining 15-40% of the variation in top wealth shares after 11 years. Shocks to differential rates of return on the other hand are insignificant in the UK and France and are therefore not included in the further specifications below.

Place Figure 4 here
Place Table 1 here

5.3. *The effects of the deep determinants on top wealth shares*

This section presents Model IIA-C which introduces the deep determinants of top wealth shares to the model along with the top 1% income share. Differential rate of returns are dropped as they are insignificant in the UK and France. These models are estimated for the period of 1970-2014.[14]

The OIRF results from Model IIA, which includes top marginal tax rate on inheritance, is presented in Figure 5. The main finding is that across all three countries, shocks to labour's bargaining power are significant and lead to a decline in top 1% wealth shares. In the UK and the USA, a 1%-point increase in union density leads to a 0.34 %-point and 0.42%-point decline in top wealth shares after 10 years, respectively. In France, a 1%-point increase in collective bargaining coverage leads to a much bigger drop in top wealth shares in the short run (1.6 %-points after 3 years), although the impact is less persistent and dies out by the 10^{th} year. This result is robust to all alternative orderings of the deep determinants, as reported in Figure A4 in the online Appendix.

The impact of technological change on top wealth shares is only significant in the USA, where a 1%-point increase in ICT capital intensity leads to a 1.9%-point increase in top wealth shares after 10 years.[15] One potential explanation for this variable being significant in only the USA and not the other countries is that, as the USA is home to the headquarters of the largest

[13] We test whether re-ordering income inequality and wealth inequality with respect to each other changes the results. As shown in Figure A3, shocks to top 1% income leads to a decline in top wealth shares in both cases, regardless of the order.
[14] 1970 is the first year of data available for the ICT capital intensity series and the KOF index.
[15] To put this into perspective, ICT capital intensity ratio in the USA increased from 0.8% in 1970 to 10.5% in 2014, so a 1%-point change is roughly a 10th of the variation of the variable over the sample.

ICT companies in the world, the top 1% is populated by the owners and top managers of these companies who particularly benefit from the growth of ICT capital.

A shock to de jure financial globalisation is insignificant across all countries. As a robustness test, we re-estimate Model IIA replacing financial globalisation with a measure of trade globalisation, with the results presented in Figure A5. While trade globalisation is marginally more significant than financial globalisation, we find that the impact of labour's bargaining power remains significant across all three countries.

Lastly, shocks to top inheritance tax rates are insignificant in all three specifications. We test to see whether replacing top inheritance tax rates with top income tax rates give the same result in Figure A6. A shock to top income tax rates does lead to a decline in top wealth shares in the UK but remains insignificant in the USA and France. The only variable that remains significant across all three countries is the direct measure of labour's bargaining power.

Why are the effects of globalisation, technology and progressive taxes on top wealth shares relatively insignificant, given the existing theoretical literature? As discussed in the theoretical framework, top marginal tax rates can reduce inequality by taxing away the rents at the top of the distribution, and therefore dampening the willingness of capitalists and top earners to bargain with labour. However, this bargaining channel might already by captured by the direct measure of bargaining power included in the regression. To test this, we re-estimate the system dropping all variables from the model except top inheritance tax rates, top income shares and top wealth shares. The results, as presented in Figure A7, show that the effect of a shock to top inheritance tax rates become significant in the UK and the USA after 8 lags, although it stays negative for France.[16] This suggests that inheritance tax rates are having some impact on top wealth shares via the bargaining channel.

A similar problem of multicollinearity between globalisation and technological change might also be driving the insignificance of these variable, as globalisation and technological change are expected to increase inequality through the same channel (namely via labour saving and skill biased structural change). We re-estimate two more specifications, dropping globalisation and technological change respectively, with the results presented in Figure A8 and A9. There are no significant changes to the results. De jure globalisation is insignificant in the USA and France, technological change is only significant in the USA and labour's bargaining power is robust – remaining significant across all three countries.

Place Figure 5 here

Given that in the UK and the USA there are competing factors driving top wealth shares, it is useful to look at the FEVDs in Table 2 which shows how much of the variation in top wealth shares is explained by each shock. The results corroborate the finding that the most significant determinant of top wealth shares is labour's bargaining power. In the UK, USA and France, shocks to labour's bargaining power explains 42%, 10% and 32% of the variation in top wealth shares respectively after 11 years. The only other deep determinant that explains top wealth shares is technology shocks in the USA, which explains 20% of the variation in top wealth shares after 11 years.

[16] Interestingly, we find that top rate income taxes also become significant once the other variables in the system are dropped.

Place Table 2 here

Through which channel does labour's bargaining power impact wealth inequality? The theoretical framework highlights three potential channels: (i) a production channel via differential rate of return and personal income inequality; (ii) a bargaining channel via personal income inequality; and (iii) a pension channel via the differential saving rate. We find evidence in favour of the bargaining channel via personal income inequality across all three countries. We test the significance of this channel directly by analysing the impact of labour's bargaining power on the top 1% income share in Figure 6. A positive shock to labour power leads to a significant decline in top 1% income shares across all three countries. Given the insignificance of differential rates of returns, at least in the UK and France, this effect must be captured by the bargaining channel.

Place Figure 6 here

We also estimate the extent to which the impact of labour power on wealth inequality is due to income inequality or differential savings rates/inheritances. Comparing Model IIA to Model I, we see that there is a decline in both the explanatory power of income inequality and differential saving rates/inheritances once we include the deep determinants. This means that the deep determinants – and labour's bargaining power in particular[17] - are causing changes in wealth inequality via their impact on income inequality and savings/inheritances.

Given the insignificance of top rate inheritance tax rates in Model IIA, we now replace this variable with another fiscal indicator: the net public wealth as a ratio to national income. We find, as shown in Figure 7 below, that a shock to public wealth is only significant in the UK and France (and much more so in the latter) while in the USA it is insignificant. Interestingly, as the shock to public wealth leads to a *decline* in top 1% wealth shares, this provides initial evidence against the precautionary savings channel and in favour of the bargaining or windfall channel discussed above.

A potential explanation for the cross-country differences is the different composition of net public wealth in the three countries. In France, public wealth tends to be held in the form of assets that ultimately provide public services that increase the bargaining power of French workers – hospitals, schools etc. In the USA, and to some extent the UK, the composition of state assets and spending is more skewed towards military assets that do not have the social wage character (Lin et al, 2013). Therefore, despite all countries seeing a decline in net public wealth/national income ratios from around 50-100% in the 1970s to close to 0 today, this has only led to an increase in top wealth shares in the UK and France, where it might have potentially affected labour's bargaining power. One potential corroboration of this finding is that if we replace net public wealth/national income in the USA with government spending on individuals/GDP, which would partly capture the governments provision of a social wage, the relationship between government spending and top 1% share of wealth becomes significant and negative, as can be seen in Figure A10.

Place Figure 7 here

[17] As labour's bargaining power is the only significant deep determinant across all three countries.

The last empirical question of this paper is to test whether the homeownership rate has an impact on top wealth shares. We do this by estimating Model IIC, which replaces the inheritance tax rates with a homeownership rate variable. As can be seen in Figure 8, the effect of an increase in homeownership rates on the top 1% wealth share is insignificant in all three countries. The effect of a positive shock to labour's bargaining power on top wealth shares however remains robust across all three countries.

Place Figure 8 here

One potential issue due to the short time series dimension of the data is the low degrees of freedom in model II, where we estimate 18 parameters (6 variables with two lags) with only 44 observations in the sample for each country. To test that this is not a problem driving our main results, we estimate three alternative versions of the model with fewer variables reported in the online Appendix, excluding both inheritance taxes and technology in Figure A8, excluding both inheritance taxes and globalisation in Figure A9, and excluding just inheritance tax rates in Figure A11. The significant impact of labour's bargaining power on wealth inequality remains robust across all specifications, and we conclude that the low degrees of freedom is not driving the results. Furthermore, we also find that the effect of public wealth on wealth inequality is robust even in a smaller system where we drop labour's bargaining power as can be seen in Figure A12.

6. CONCLUSION

This paper analyses the determinants of the top 1% wealth share in the UK, the USA and France based on the effects of the components and the deep determinants of wealth inequality using structural vector autoregression (SVAR) estimations for the periods of 1919-2014 and 1970-2014. With respect to the components of wealth inequality, we find that a positive shock to the top 1% share of income significantly increases top 1% share of wealth across all three countries. Differential rates of returns on the other hand only have a significant impact on top wealth shares in the USA. This raises the question regarding the deeper drivers of wealth inequality and how it relates to the determinants of income inequality widely discussed in the literature.

The results indicate that the bargaining power of labour is the most significant and robust deep determinant of the top 1% wealth share across all the models and countries, shown by a significant negative impact of an increase in union density or collective bargaining coverage on top wealth shares. Quantitatively, labour's bargaining power explains 42%, 11% and 32% of the variation in top wealth shares in the UK, the USA and France respectively over the period of 1970-2014. We also show that the labour's bargaining power influences wealth inequality via income inequality.

Furthermore, we find that a decline in public wealth increases wealth inequality in the UK and France, but not in the USA. This is consistent with the expectation that a decline in public wealth reduces the bargaining power of labour and provides a windfall gain for the top 1%. On the other hand, we find that homeownership rates do not have a significant impact on the top 1% wealth share in any country.

Lastly, top marginal income tax rates lead to a decline in top wealth shares in the UK but are insignificant in the USA and France, while the effect of top marginal inheritance tax rates appears to be insignificant in all cases.

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FIGURES

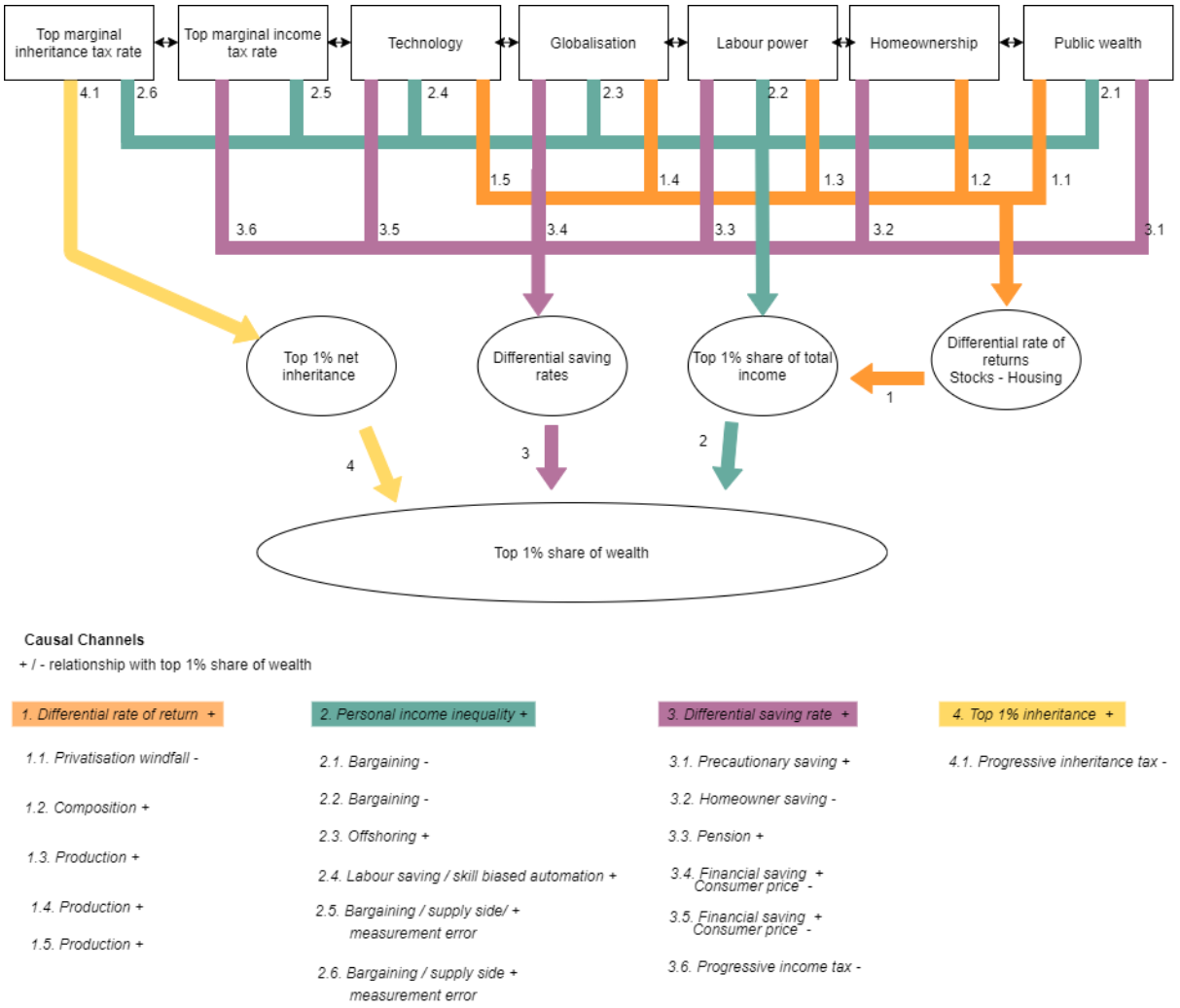


Figure 1. The contemporaneous causal relationships between the components and deep determinants of the top 1% wealth share.

Notes: Circles in the main figure denote the components of wealth inequality. Rectangles denote the deep determinants of wealth inequality.

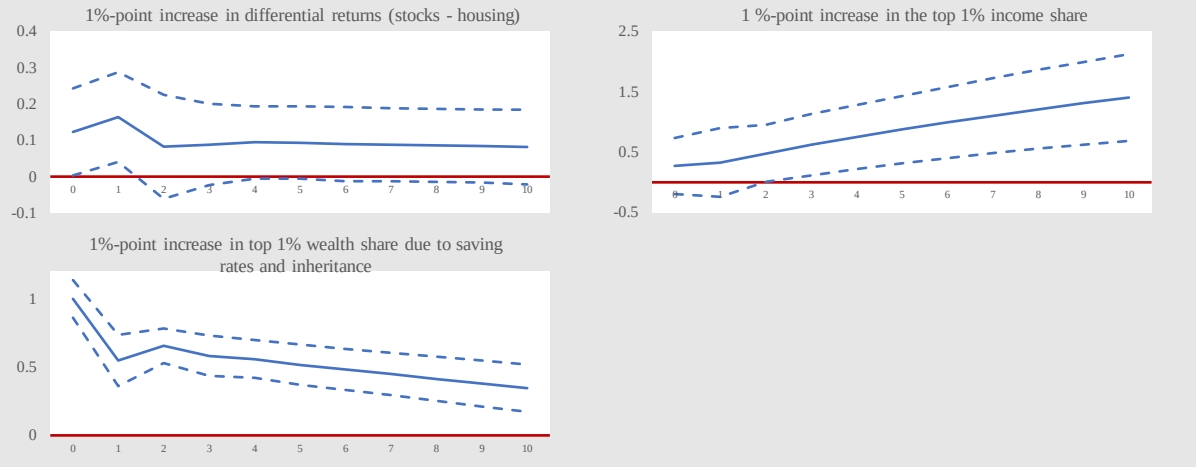
$$\begin{pmatrix} e_{0t}^{\text{rate of return stocks-rate of return housing}} \\ e_{1t}^{\text{top 1\% income share}} \\ e_{2t}^{\text{top 1\% wealth share}} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ b_1 & 1 & 0 \\ b_2 & b_3 & 1 \end{bmatrix} \begin{pmatrix} u_{0t}^{\text{differential return shock}} \\ u_{1t}^{\text{other shock to top 1\% income}} \\ u_{2t}^{\text{diff saving \& inheritance shock}} \end{pmatrix}$$

Figure 2. Model I Identification Matrix

$$\begin{pmatrix} e_{0t}^{\text{top inheritance tax rate}} \\ e_{1t}^{\text{financial globalisation (KOF)}} \\ e_{2t}^{\text{real ICT capital intensity}} \\ e_{3t}^{\text{union density or collective bargaining coverage}} \\ e_{4t}^{\text{top 1\% income share}} \\ e_{5t}^{\text{top 1\% wealth share}} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ b_1 & 1 & 0 & 0 & 0 & 0 \\ b_2 & b_3 & 1 & 0 & 0 & 0 \\ b_4 & b_5 & b_6 & 1 & 0 & 0 \\ b_7 & b_8 & b_9 & b_{10} & 1 & 0 \\ b_{11} & b_{12} & b_{13} & b_{14} & b_{15} & 1 \end{bmatrix} \begin{pmatrix} u_{0t}^{\text{progressive tax shock}} \\ u_{1t}^{\text{globalisation shock}} \\ u_{2t}^{\text{technology shock}} \\ u_{3t}^{\text{bargaining shock}} \\ u_{4t}^{\text{other shock to top 1\% income}} \\ u_{5t}^{\text{other diff saving \& inheritance shock}} \end{pmatrix}$$

Figure 3. Model IIA Identification Matrix

UK



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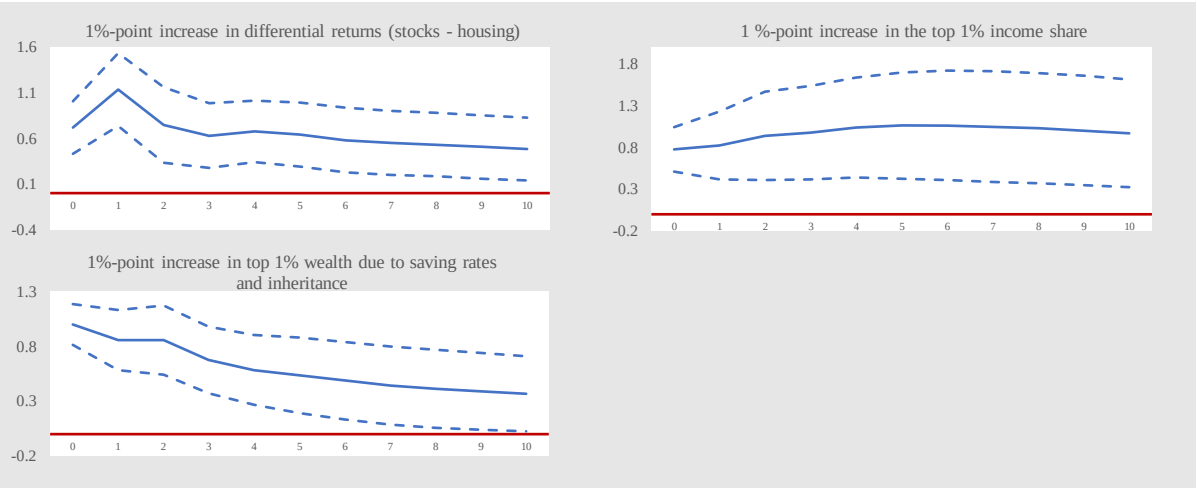

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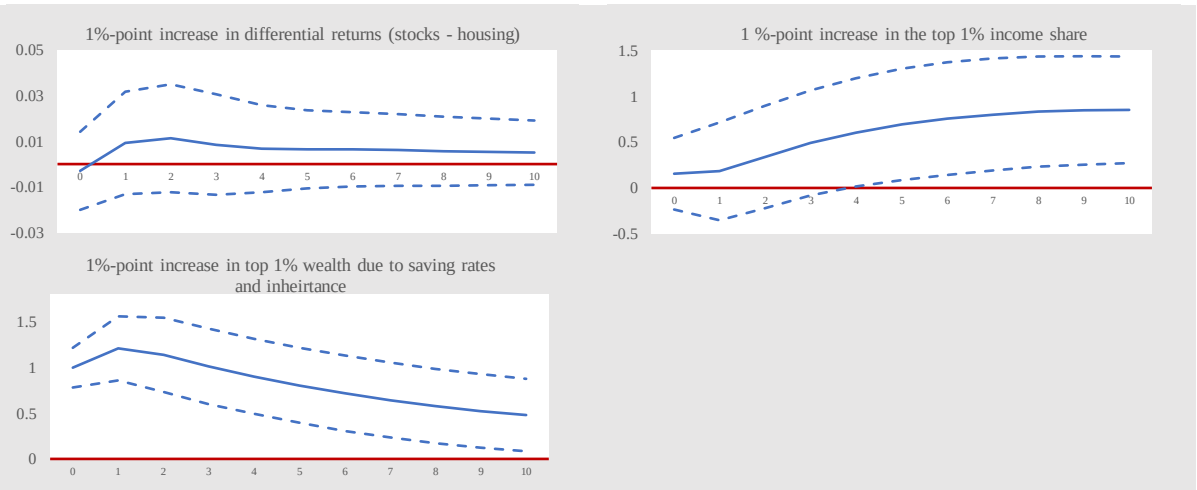
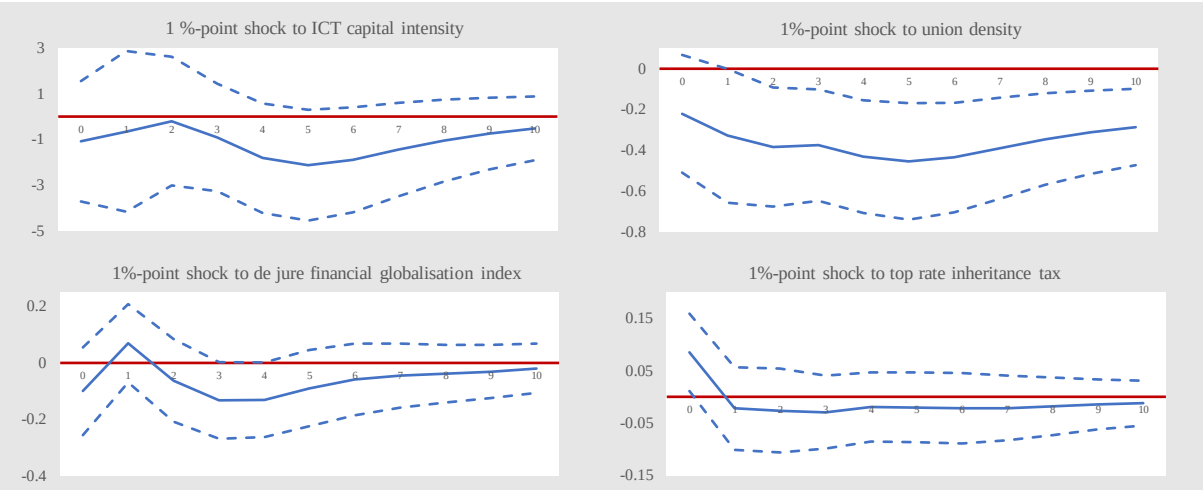


Figure 4. Orthogonalized impulse response function: effects of components of wealth on the top 1% wealth share

Note: Sample period: 1919-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: years. y axis: %-point change in the top 1% wealth share.

UK



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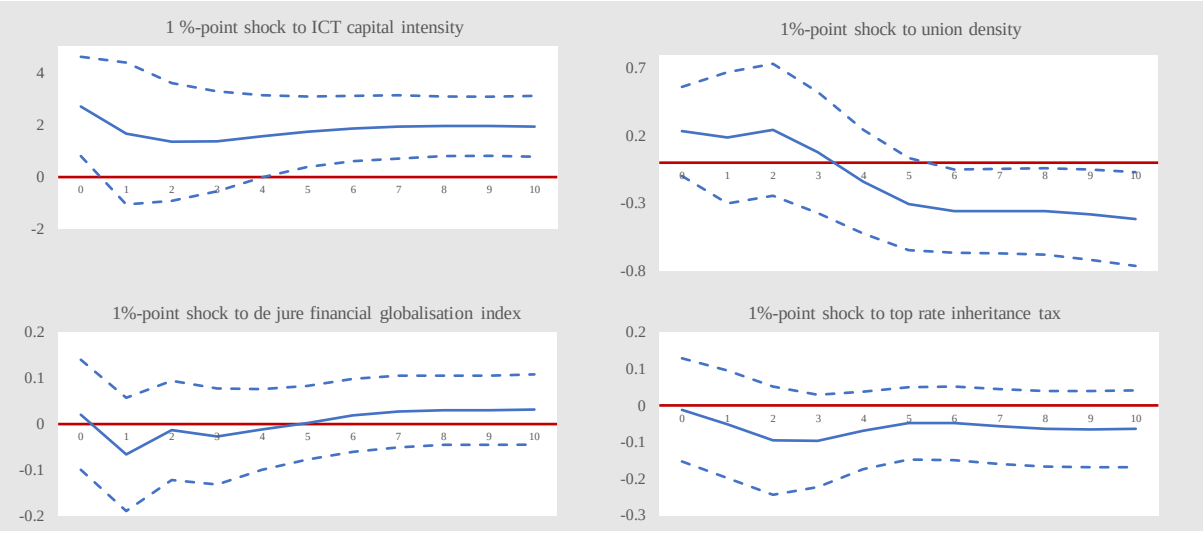

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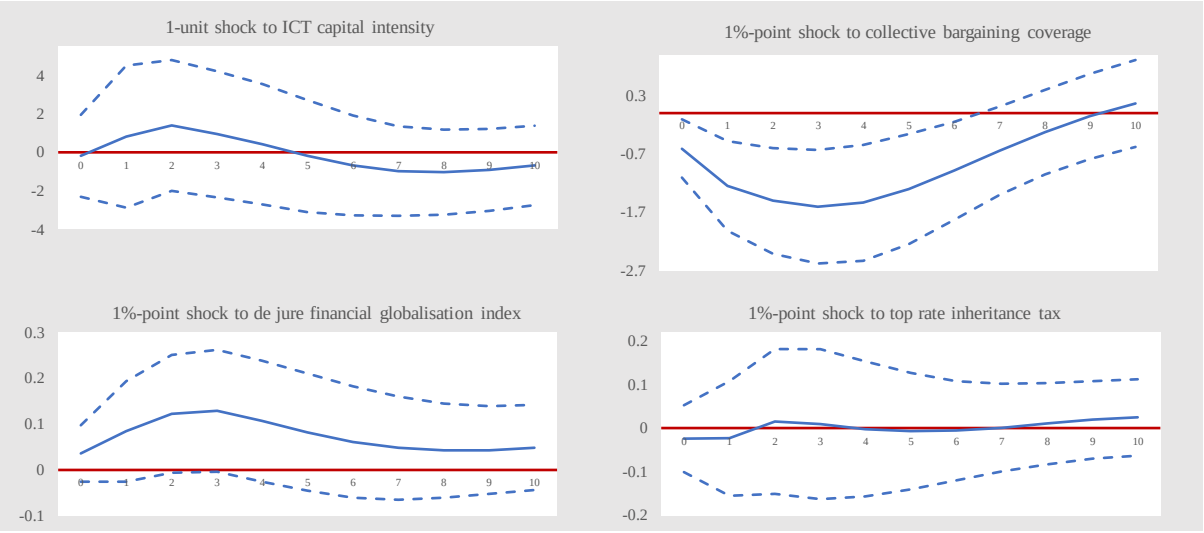
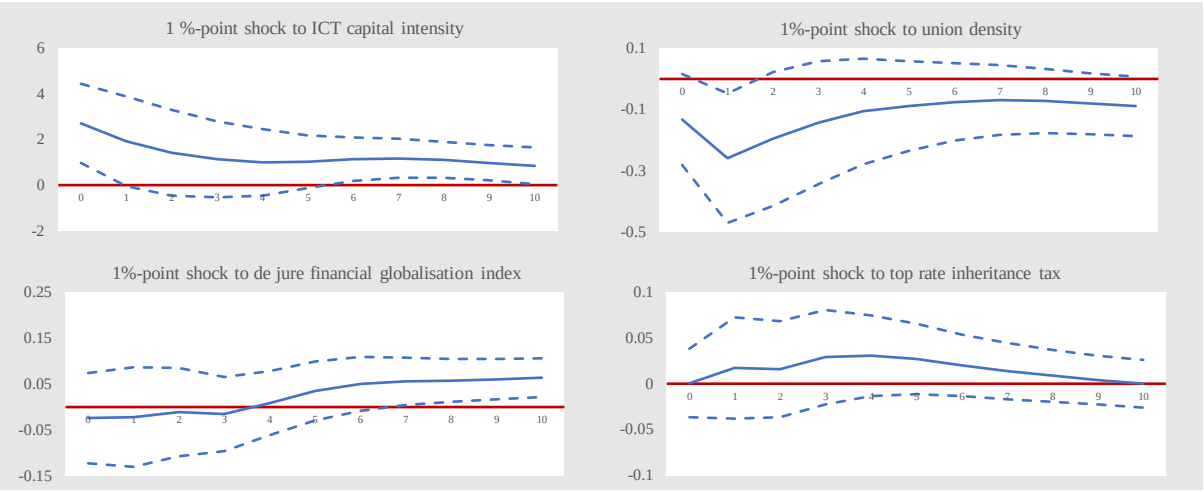


Figure 5. Orthogonalized impulse response function: effects of deep determinants with top inheritance tax rate on the top 1% wealth share

Notes: Sample period: 1970-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: years. y axis: %-point change in the top 1% wealth share.

UK



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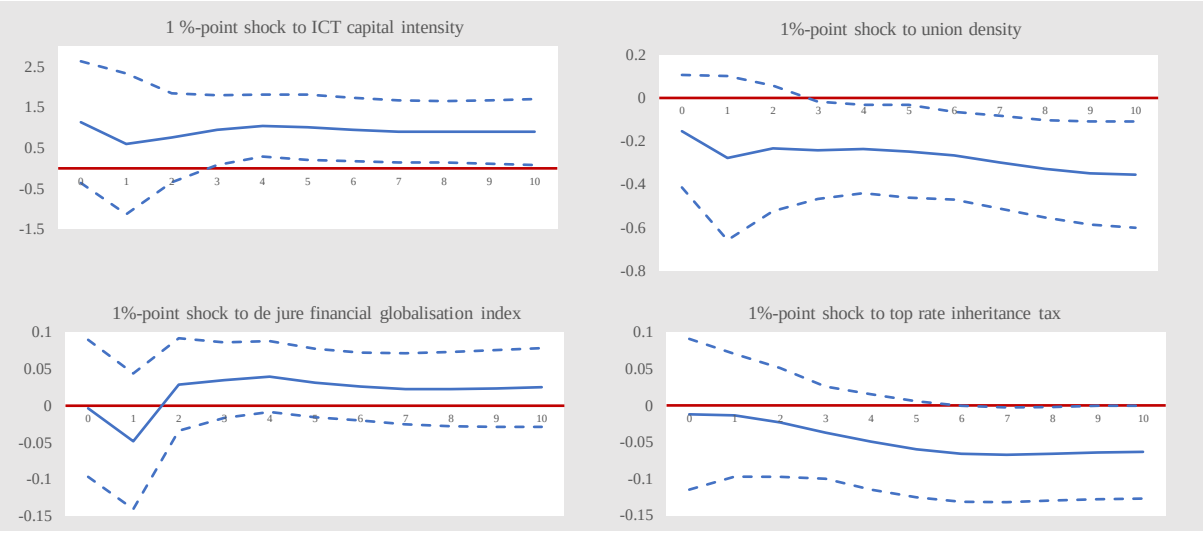

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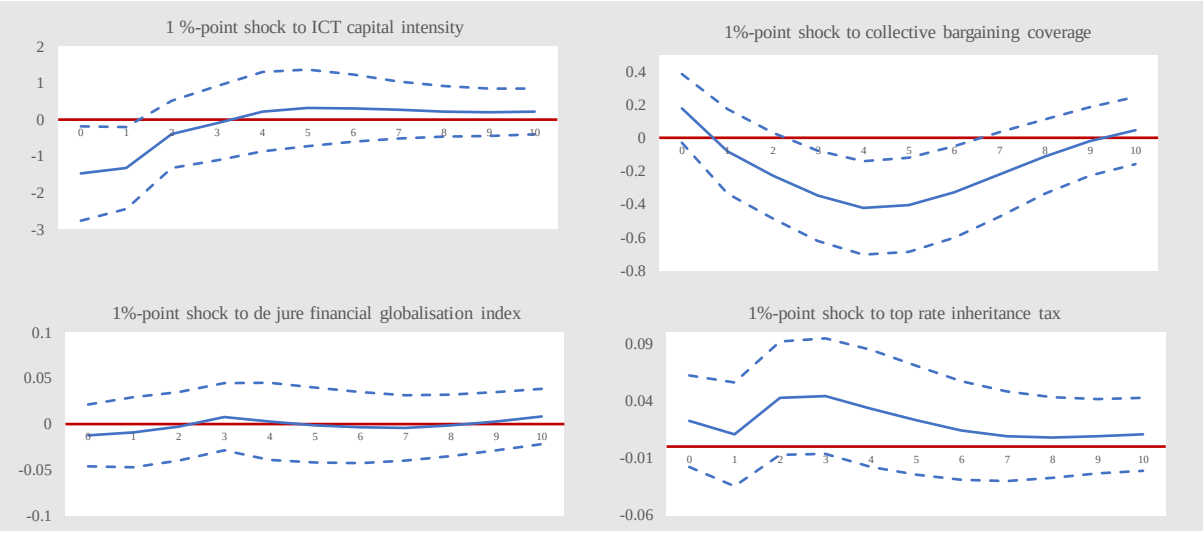
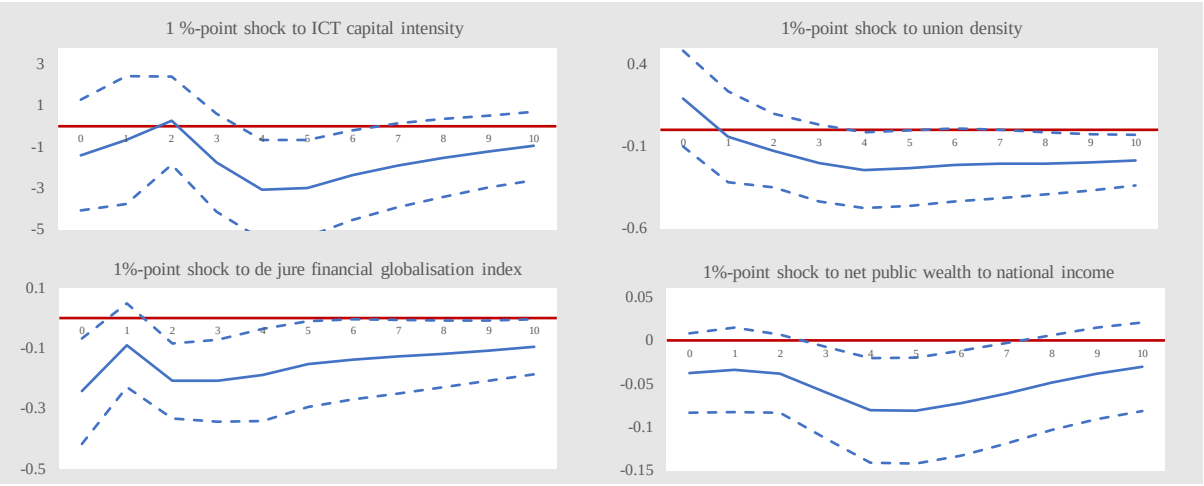


Figure 6. Orthogonalized impulse response function: effects of deep determinants with top inheritance tax rate on the top 1% income share

Notes: Sample period: 1970-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: years. y axis: %-point change in the top 1% wealth share.

UK



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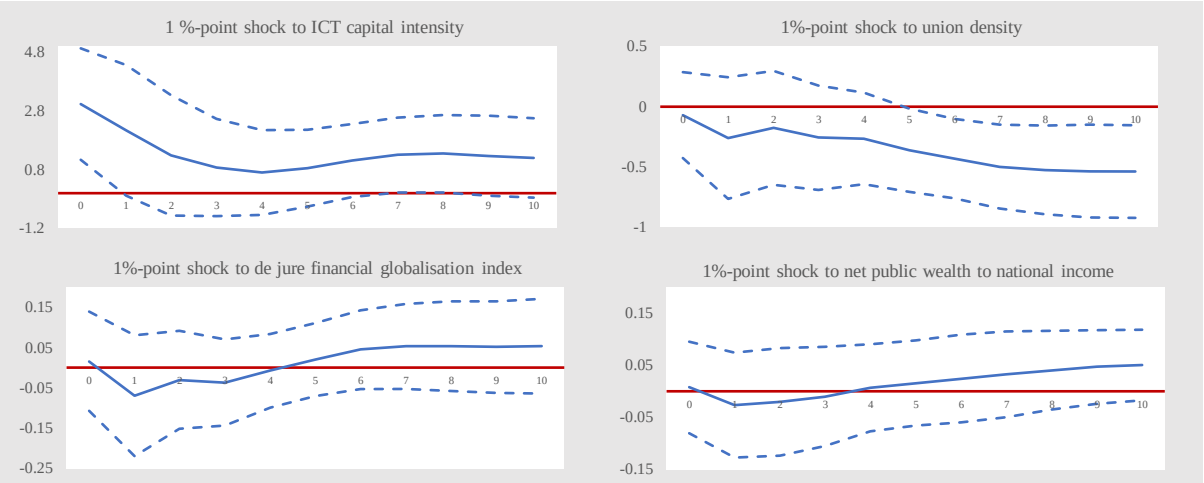

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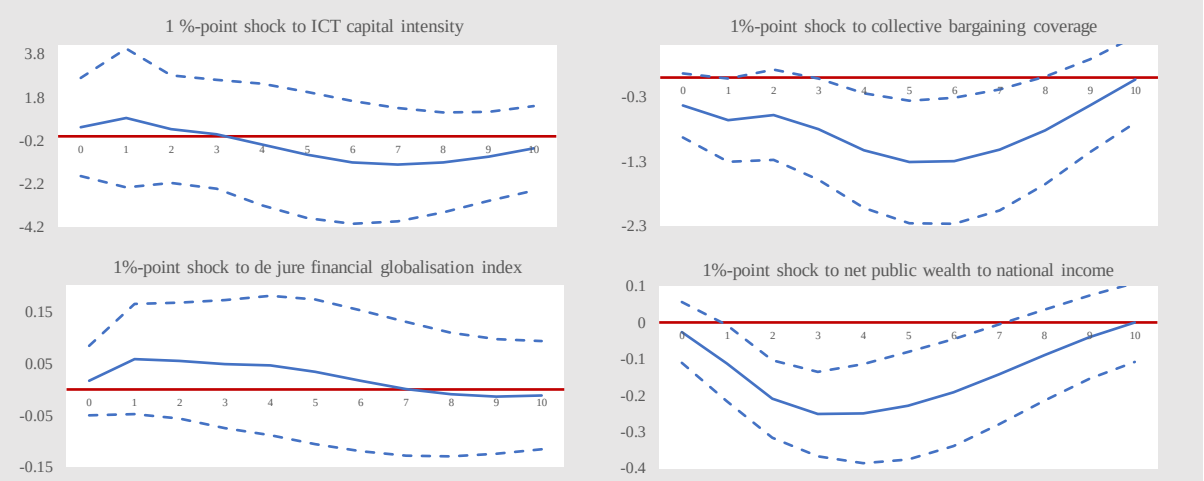
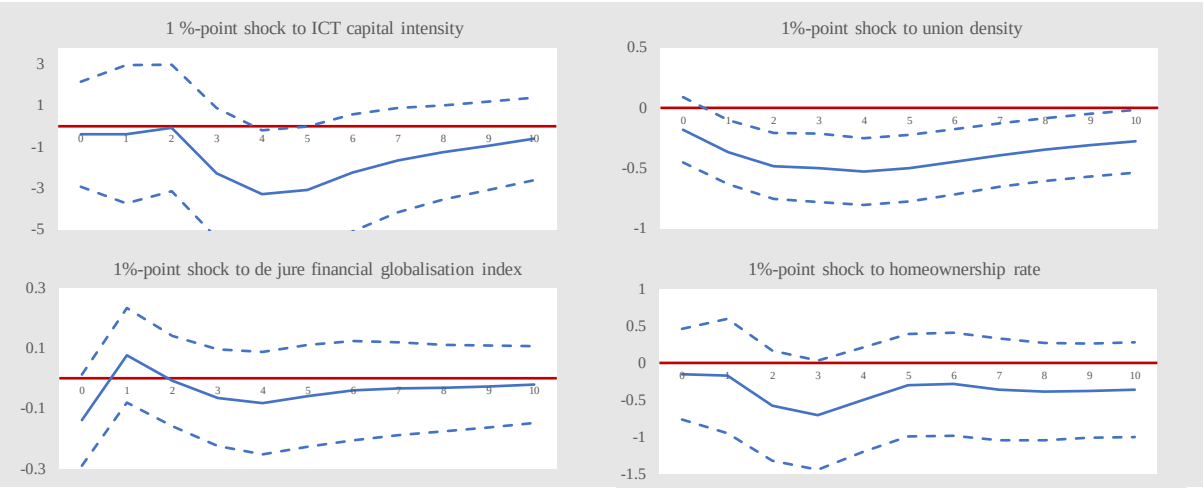


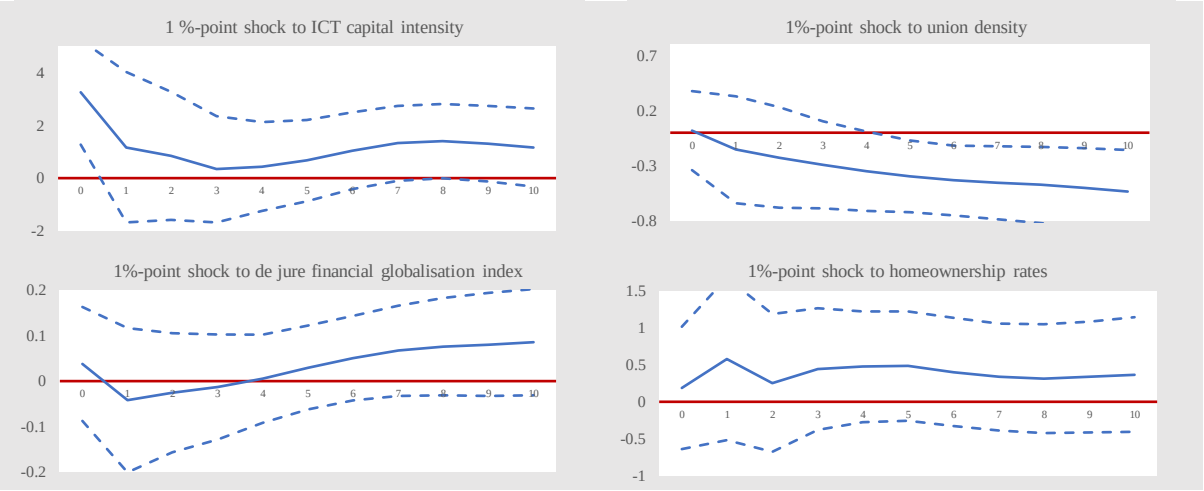
Figure 7. Orthogonalized impulse response function: effects of deep determinants with net public wealth on top 1% wealth share

Notes. Sample period: 1970-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: years. y axis: %-point change in the top 1% wealth share.

UK



USA



France

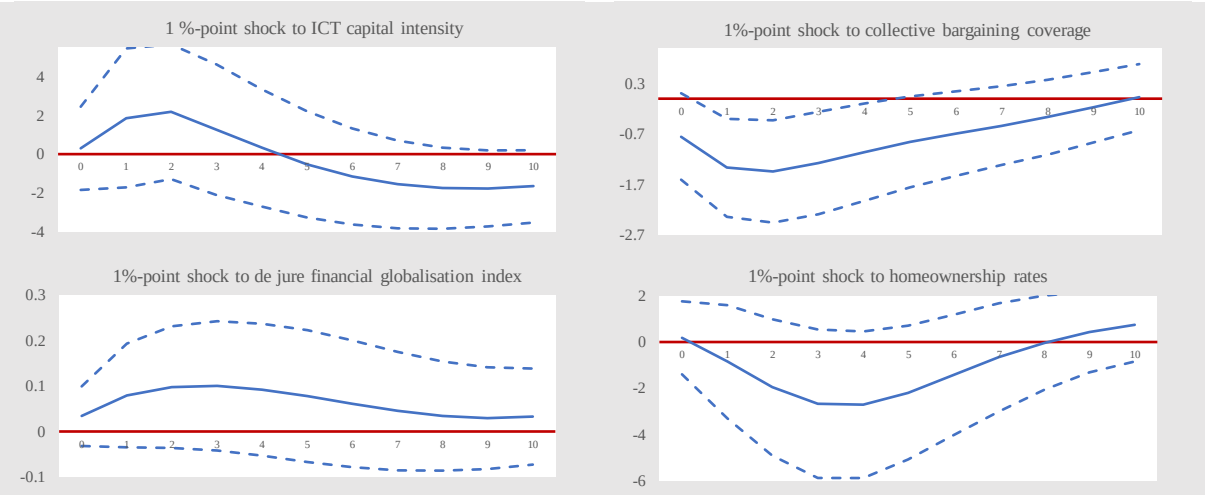


Figure 8. Orthogonalized impulse response function: effects of deep determinants with homeownership rates on the top 1% wealth share

Notes: Sample period: 1970-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: annual years. y axis: %-point change in the top 1% wealth share.

TABLES

TABLE 1

FEVD results - variation of top wealth shares explained by components (%)

Horizon (Years)	**Differential rate of return**	**Other shocks to top 1% income share**	**Differential saving rates and top 1% inheritance**
		UK	
1	5	1	93**
7	8	14	78**
11	8	29**	64**
		USA	
1	28**	21**	51**
7	34**	35**	30**
11	32**	42**	26**
		France	
1	0	1	99**
7	2	8	90**
11	2	15	83**

Note: * is significant at 90% level | ** is significant at 95% level

TABLE 2

FEVD results - variation of top wealth shares explained by deep determinants (%)

Horizon (Years)	Top rate inheritance tax	Financial globalisation	Technological change	Labour's bargaining power	Other shocks to top 1% income share	Differential saving rates and top 1% inheritance
			UK			
1	11	3	1	5	0	80**
7	6	8	4	5**	3	43**
11	5	7	5	42**	4	37**
			USA			
1	0	0	13	2	53**	31**
7	6	1	1	5	49**	24**
11	7	1	20*	10*	41**	20**
			France			
1	0	2	0	11	10	76**
7	0	10	0	33**	1	55**
11	0	10	0	32**	2	54**

Note: * is significant at 90% level | ** is significant at 95% level. In the USA, "other shocks to top 1% income share" also incorporates the differential rates of returns, as they were only significant in this country.

Online Appendix: SUPPORTING INFORMATION

TABLE A1

Data: The components of the top 1% wealth share

Variable Name	Description	Source		Period	Mean	Std Dev	Min	Max
Top 1% share of net personal wealth (%)	Net personal wealth (housing, land, deposits, bonds, equities, etc.) held by top 1% wealthiest individuals.	WID	UK	1895-2017	.3956	.1972	.152	.7377
			USA	1913-2016	.3202	.0718	.2101	.4824
			France	1902-2014	.3284	.1301	.1579	.569
Top 1% share of personal income (%)	Pre-tax national income share held by top 1% individuals.	WID	UK	1918-2019	.1362	.0510	.0692	.237
			USA	1913-2019	.1642	.0310	.1103	.215
			France	1915-2017	.1275	.0447	.0733	.2327
Differential rate of return (%)	The real total return on equities minus the real total return on housing. Total real return is sum of the change in the price of asset plus the yield return of asset divided by the CPI (i.e. the yearly change in the general price level).	JSTdatasetR4 (Release 4, May 2019)	UK	1896-2015	.0020	.0299	-.1061	.1074
			USA	1896-2015	.0013	.0137	-.0376	.0462
			France	1896-2015	-.0892	.4945	-2.6926	1.1207

TABLE A2

Data: The deep determinants of the top 1% wealth share

Variable Name	Description	Source		Period	Mean	Std Dev	Min	Max
Real ICT Capital Intensity (%)	National real ICT capital stock divided by real gross value added.	EU KLEMS	UK	1970-2015	.0362	.0260	.0043	.0719
			USA	1970-2015	.0429	.0325	.0083	.1053
			France	1970-2015	.0496	.0241	.0055	.0922
Financial globalisation de jure (KOF) (Index 0-100)	De jure index of financial globalisation from KOF. The index is constructed from four variables: investment restrictions; capital account openness; international investment agreements; and international voice traffic.	Gygli et al (2019)	UK	1970-2017	81.34	12.70	39.85	93.18
			USA	1970-2017	72.78	11.75	57	90.7
			France	1970-2017	75.71	10.81	41.85	90.42
Trade globalisation de jure (KOF) (Index 0-100)	De jure index of trade globalisation from KOF. The index is constructed from four variables: trade regulations; trade taxes; tariffs; and trade agreements.	Gygli et al (2019)	UK	1970-2017	87.367	5.74	75.06	97.11
			USA	1970-2017	75.61	8.84	62.63	88.17
			France	1970-2017	86.36	5.36	77.12	95.78
Trade union density (%)	The proportion of total employees who are members of a trade union across the whole economy.	OECD, Bain and Price (1980), Freeman (1998), Ebbinghaus and Visser (2000)	UK	1895-2018	.31465	.1148	.0907	.522
			USA	1895-2018	.1695	.0799	.0379	.3222
			France	1950-2018	.1552	.0624	.085	.2972
Collective bargaining coverage (%)	Percentage of employees with the right to bargain.	OECD	UK	1960-2017	.5698	.2147	.26	.85
			USA	1960-2017	.2060	.0748	.115	.34
			France	1960-2014	82.26	16.99	50	98.5
Top marginal income tax rate (%)	The maximum amount of tax paid on an additional unit of income for highest income earners.	WID	UK	1909-2017	.5953	.3023	0	.98
			USA	1900-2017	.5150	.2940	0	.94
			France	1915-2017	.480	.220	0	.72
Top marginal inheritance tax rate (%)	The maximum amount of tax paid on an additional unit of inheritance for the highest inheritances.	WID	UK	1900 -2017	.5098	.2306	.08	.85
			USA	1900-2017	.4954	.2692	0	.77
			France	1900-2017	.2537	.1206	.02	.45
Net Public Wealth to Net National Income Ratio (%)	The net wealth of the public sector as a proportion of net national income.	Piketty & Zucman (2014), Estevez-Bauluz (2017)	UK	1970-2015	.5176	.3800	-.2428	1.0879
			USA	1970-2015	.3015	.2131	-.1705	.6374
			France	1970-2015	.4747	.1390	.17	.71
Individual government expenditure/GDP (%)	Government spending on individuals as a proportion of GDP.	OECD	UK	1970-2019	.1085	.0140	.0823	.1372
			USA	1970-2019	.0605	.0027	.0552	.0676
			France	1970-2019	.1351	.0164	.09752	.1569
Homeownership rate (%)	Percentage of all households that are owner occupied.	GOV.UK, Kohl (2017) and INSE	UK	1939-2018	.5336	.1429	.32	.7088
			USA	1950-2019	.6279	.0540	.436	.69
			France	1946-2019	.4852	.0845	.293	.579

TABLE A3

Post-estimation tests for Model I

Residual Autocorrelation Test				
Country	lag	chi2	df	Prob>chi2
UK	1	28.10406	9	0.000916
	2	26.45002	9	0.001724
USA	1	13.28396	9	0.150173
	2	3.346059	9	0.948982
France	1	33.30852	9	0.000118
	2	8.570607	9	0.477816

Normality Tests					
Country	Skewness test	Skewness	chi2	df	Prob > chi2
UK	Differential rate of returns	0.392086	2.434077	1	0.11
	top 1% income share	-0.03968	0.024934	1	0.87
	top 1% wealth share	0.213581	0.722265	1	0.39
	all		3.181275	3	0.36
USA	Differential rate of returns	0.426208	3.057832	1	0.08
	top 1% income share	-6.6E-05	7.3E-08	1	0.99
	top 1% wealth share	-0.20901	0.735394	1	0.39
	all		3.793227	3	0.285
France	Differential rate of returns	-0.89933	12.40141	1	0.00
	top 1% income share	-0.23015	0.81217	1	0.36
	top 1% wealth share	-0.40726	2.543154	1	0.11
	all		15.75673	3	0.00

Information Criteria Model II									
Country	lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
UK	0	480.9292				8.57E-09	-10.0617	-10.0291	-9.98102
	1	882.9666	804.0748	9	2.8E-167	2.18E-12	-18.3361	-18.2058	-18.0135*
	2	894.668*	23.40279*	9	0.005352	2.07E-12*	-18.393*	-18.1649*	-17.8285
USA	0	713.2021				1.57E-10	-14.0634	-14.032	-13.9857
	1	954.868	483.3316	9	2.13E-98	1.56E-12	-18.6707	-18.5449	-18.3599*
	2	970.009*	30.28203*	9	0.000393	1.39E-12*	-18.7923*	-18.5721*	-18.2485
France	0	318.5939				2.1E-07	-6.86074	-6.82755	-6.7785
	1	593.6516	550.1155	9	1.1E-112	6.47E-10	-12.6446	-12.5118	-12.3157*
	2	609.7176*	32.13198*	9	0.000189	5.56E-10*	-12.7982*	-12.5659*	-12.2226

Stability Test – Modulus of Eigenvalues						
UK	0.983739	0.983739	0.417194	0.417194	0.338199	0.016375
USA	0.963044	0.585436	0.576906	0.516489	0.516489	0.196651
France	0.959284	0.806316	0.515931	0.515931	0.340129	0.002328

TABLE A4

Postestimation tests for Model II

Residual Autocorrelation Test

Country	lag	chi2	df		Prob>chi2
UK	1	42.15555	36		0.222019
	2	38.98685	36		0.33693
USA	1	41.67041	36		0.237682
	2	40.41966	36		0.281344
France	1	28.75545	36	0.799214	28.75545
	2	31.78312	36	0.669434	31.78312

Normality Tests

Country	Skewness test	Skewness	chi2	df	Prob > chi2
UK	globalisation	0.465253	1.587374	1	0.20
	public wealth	-0.81615	4.884795	1	0.02
	ICT capital intensity	-0.10634	0.082929	1	0.77
	Union density	0.115945	0.098583	1	0.75
	top 1% income share	0.277094	0.56306	1	0.45
	top 1% wealth share	0.138401	0.14047	1	0.70
	all		7.357211	6	0.28
USA	globalisation	0.245753	0.442895	1	0.50
	public wealth	-0.16664	0.203638	1	0.65
	ICT capital intensity	0.008623	0.000545	1	0.98
	Union density	1.297805	12.35152	1	0.00
	top 1% income share	-0.01131	0.000938	1	0.97
	top 1% wealth share	0.107885	0.085354	1	0.77
	all		13.08489	6	0.04
France	globalisation	-1.03123	7.621338	1	0.00
	public wealth	0.013593	0.001324	1	0.97
	ICT capital intensity	-0.26667	0.509644	1	0.473
	collective bargaining	0.91878	6.049787	1	0.01
	top 1% income share	-0.36237	0.941068	1	0.33
	top 1% wealth share	0.632359	2.865792	1	0.09
	all		17.98895	6	0.01

Information Criteria Model II

Country	lag	LL	LR	df	p	FPE	AIC	HQIC	SBIC
UK	0	367.4288				2.95E-15	-16.4286	-16.3384	-16.1853
	1	685.7991	636.7405	36	5.7E-111	8E-21	-29.2636	-28.632	-27.5605*
	2	742.5067*	113.4153*	36	6.07E-10	3.43E-21*	-30.2049*	-29.0319*	-27.042
USA	0	401.6662				6.23E-16	-17.9848	-17.8946	-17.7415
	1	749.701	696.0695	36	3.4E-123	4.38E-22	-32.1682	-31.5366*	-30.4651*
	2	789.5278*	79.65371*	36	3.84E-05	4.04E-22*	-32.3422*	-31.1692	-29.1793
France	0	171.6026				1.82E-11	-7.70245	-7.61182	-7.4567
	1	529.9104	716.6156	36	1.9E-127	5.72E-18	-22.6935	-22.0591	-20.9733*
	2	582.7269*	105.633*	36	9.15E-09	2.89E-18*	-23.4757*	-22.2976*	-20.2809

Continued Table A4

Stability Test – Modulus of Eigenvalues						
UK	0.963648	0.963648	0.846816	0.846816	0.838225	0.838225
USA	0.963044	0.89426	0.89426	0.827934	0.827934	0.796221
France	0.993	0.893246	0.893246	0.880493	0.880493	0.809688

Figure A1. Identification Matrix for all specifications

$$\begin{pmatrix} e_{1t}^{differential\ rate\ of\ return} \\ e_{2t}^{top\ 1\%\ income\ share} \\ e_{3t}^{top\ 1\%\ wealth\ share} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ b_1 & 1 & 0 \\ b_2 & b_3 & 1 \end{bmatrix} \begin{pmatrix} u_{1t}^{differential\ return\ shock} \\ u_{2t}^{other\ shock\ to\ top\ 1\%\ income} \\ u_{3t}^{other\ shock\ to\ top\ 1\%\ wealth} \end{pmatrix}$$

Model I

$$\begin{pmatrix} e^{top\ inheritance\ tax\ rate} \\ e^{financial\ globalisation\ (KOF)} \\ e^{real\ ICT\ capital\ intensity} \\ e^{union\ density\ or\ collective\ bargaining\ coverage} \\ e^{top\ 1\%\ income\ share} \\ e^{top\ 1\%\ wealth\ share} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ b_1 & 1 & 0 & 0 & 0 & 0 \\ b_2 & b_3 & 1 & 0 & 0 & 0 \\ b_4 & b_5 & b_6 & 1 & 0 & 0 \\ b_7 & b_8 & b_9 & b_{10} & 1 & 0 \\ b_{11} & b_{12} & b_{13} & b_{14} & b_{15} & 1 \end{bmatrix} \begin{pmatrix} u_{0t}^{progressive\ tax\ shock} \\ u_{1t}^{globalisation\ shock} \\ u_{2t}^{technology\ shock} \\ u_{3t}^{bargaining\ shock} \\ u_{4t}^{other\ shock\ to\ top\ income} \\ u_{5t}^{other\ shocks\ to\ top\ wealth} \end{pmatrix}$$

Model IIA

$$\begin{pmatrix} e^{financial\ globalisation\ (KOF)} \\ e^{net\ public\ wealth\ to\ national\ income} \\ e^{real\ ICT\ capital\ intensity} \\ e^{union\ density\ or\ collective\ bargaining} \\ e^{top\ 1\%\ income\ share} \\ e^{top\ 1\%\ wealth\ share} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ b_1 & 1 & 0 & 0 & 0 & 0 \\ b_2 & b_3 & 1 & 0 & 0 & 0 \\ b_4 & b_5 & b_6 & 1 & 0 & 0 \\ b_7 & b_8 & b_9 & b_{10} & 1 & 0 \\ b_{11} & b_{12} & b_{13} & b_{14} & b_{15} & 1 \end{bmatrix} \begin{pmatrix} u_{0t}^{globalisation\ shock} \\ u_{1t}^{public\ wealth\ shock} \\ u_{2t}^{technology\ shock} \\ u_{3t}^{bargaining\ shock} \\ u_{4t}^{other\ shock\ to\ top\ income} \\ u_{5t}^{other\ shocks\ to\ top\ wealth} \end{pmatrix}$$

Model IIB

$$\begin{pmatrix} e^{financial\ globalisation\ (KOF)} \\ e^{homeownership\ rate} \\ e^{real\ ICT\ capital\ intensity} \\ e^{union\ density\ or\ collective\ bargaining} \\ e^{top\ 1\%\ income\ share} \\ e^{top\ 1\%\ wealth\ share} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ b_1 & 1 & 0 & 0 & 0 & 0 \\ b_2 & b_3 & 1 & 0 & 0 & 0 \\ b_4 & b_5 & b_6 & 1 & 0 & 0 \\ b_7 & b_8 & b_9 & b_{10} & 1 & 0 \\ b_{11} & b_{12} & b_{13} & b_{14} & b_{15} & 1 \end{bmatrix} \begin{pmatrix} u_{0t}^{globalisation\ shock} \\ u_{1t}^{homeownership\ shock} \\ u_{2t}^{technology\ shock} \\ u_{3t}^{bargaining\ shock} \\ u_{4t}^{other\ shock\ to\ top\ income} \\ u_{5t}^{other\ shocks\ to\ top\ wealth} \end{pmatrix}$$

Model IIC

Figure A2. Identification Matrix for robustness checks

$$\begin{pmatrix} e_{1t}^{differential\ rate\ of\ return} \\ e_{2t}^{top\ 1\%\ wealth\ share} \\ e_{3t}^{top\ 1\%\ income\ share} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ b_1 & 1 & 0 \\ b_2 & b_3 & 1 \end{bmatrix} \begin{pmatrix} u_{1t}^{differential\ return\ shock} \\ u_{2t}^{other\ shock\ to\ top\ 1\%\ wealth} \\ u_{3t}^{other\ shock\ to\ top\ 1\%\ income} \end{pmatrix}$$

Identification matrix for Figure A3

$$\begin{pmatrix} e^{top\ inheritance\ tax\ rate} \\ e^{trade\ globalisation\ (KOF)} \\ e^{real\ ICT\ capital\ intensity} \\ e^{union\ density\ or\ collective\ bargaining} \\ e^{top\ 1\%\ wealth\ share} \\ e^{top\ 1\%\ income\ share} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ b_1 & 1 & 0 & 0 & 0 & 0 \\ b_2 & b_3 & 1 & 0 & 0 & 0 \\ b_4 & b_5 & b_6 & 1 & 0 & 0 \\ b_7 & b_8 & b_9 & b_{10} & 1 & 0 \\ b_{11} & b_{12} & b_{13} & b_{14} & b_{15} & 1 \end{bmatrix} \begin{pmatrix} u_{0t}^{progressive\ tax\ shock} \\ u_{1t}^{globalisation\ shock} \\ u_{2t}^{technology\ shock} \\ u_{3t}^{bargaining\ shock} \\ u_{4t}^{other\ shock\ to\ top\ wealth} \\ u_{5t}^{other\ shocks\ to\ top\ income} \end{pmatrix}$$

Identification Matrix for Figure A5

$$\begin{pmatrix} e^{financial\ globalisation\ (KOF)} \\ e^{real\ ICT\ capital\ intensity} \\ e^{union\ density\ or\ collective\ bargaining} \\ e^{top\ 1\%\ wealth\ share} \\ e^{top\ 1\%\ income\ share} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ b_1 & 1 & 0 & 0 & 0 & 0 \\ b_2 & b_3 & 1 & 0 & 0 & 0 \\ b_4 & b_5 & b_6 & 1 & 0 & 0 \\ b_7 & b_8 & b_9 & b_{10} & 1 & 0 \end{bmatrix} \begin{pmatrix} u_{0t}^{globalisation\ shock} \\ u_{1t}^{technology\ shock} \\ u_{2t}^{bargaining\ shock} \\ u_{3t}^{other\ shock\ to\ top\ wealth} \\ u_{4t}^{other\ shocks\ to\ top\ income} \end{pmatrix}$$

Identification Matrix for Figure A5

$$\begin{pmatrix} e^{top\ inheritance\ tax\ rate} \\ e^{trade\ globalisation\ (KOF)} \\ e^{real\ ICT\ capital\ intensity} \\ e^{union\ density\ or\ collective\ bargaining} \\ e^{top\ 1\%\ wealth\ share} \\ e^{top\ 1\%\ income\ share} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ b_1 & 1 & 0 & 0 & 0 & 0 \\ b_2 & b_3 & 1 & 0 & 0 & 0 \\ b_4 & b_5 & b_6 & 1 & 0 & 0 \\ b_7 & b_8 & b_9 & b_{10} & 1 & 0 \\ b_{11} & b_{12} & b_{13} & b_{14} & b_{15} & 1 \end{bmatrix} \begin{pmatrix} u_{0t}^{progressive\ tax\ shock} \\ u_{1t}^{globalisation\ shock} \\ u_{2t}^{technology\ shock} \\ u_{3t}^{bargaining\ shock} \\ u_{4t}^{other\ shock\ to\ top\ wealth} \\ u_{5t}^{other\ shocks\ to\ top\ income} \end{pmatrix}$$

Identification Matrix for Figure A6

$$\begin{pmatrix} e_{1t}^{top\ inheritance\ tax\ rate} \\ e_{2t}^{top\ 1\%\ wealth\ share} \\ e_{3t}^{top\ 1\%\ income\ share} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 \\ b_1 & 1 & 0 \\ b_2 & b_3 & 1 \end{bmatrix} \begin{pmatrix} u_{1t}^{progressive\ tax\ shock} \\ u_{2t}^{other\ shock\ to\ top\ 1\%\ wealth} \\ u_{3t}^{other\ shock\ to\ top\ 1\%\ income} \end{pmatrix}$$

Identification Matrix for Figure A7

$$\begin{pmatrix} e^{financial\ globalisation\ (KOF)} \\ e^{union\ density\ or\ collective\ bargaining\ coverage} \\ e^{top\ 1\%\ income\ share} \\ e^{top\ 1\%\ wealth\ share} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ b_1 & 1 & 0 & 0 \\ b_2 & b_3 & 1 & 0 \\ b_4 & b_5 & b_6 & 1 \end{bmatrix} \begin{pmatrix} u_{0t}^{globalisation\ shock} \\ u_{1t}^{public\ wealth\ shock} \\ u_{2t}^{other\ shock\ to\ top\ income} \\ u_{3t}^{other\ shocks\ to\ top\ wealth} \end{pmatrix}$$

Identification Matrix for Figure A8

$$\begin{pmatrix} e^{real\ ICT\ capital\ intensity} \\ e^{union\ density\ or\ collective\ bargaining\ coverage} \\ e^{top\ 1\%\ income\ share} \\ e^{top\ 1\%\ wealth\ share} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 \\ b_1 & 1 & 0 & 0 \\ b_2 & b_3 & 1 & 0 \\ b_4 & b_5 & b_6 & 1 \end{bmatrix} \begin{pmatrix} u_{0t}^{SBTC\ shock} \\ u_{1t}^{public\ wealth\ shock} \\ u_{2t}^{other\ shock\ to\ top\ income} \\ u_{3t}^{other\ shocks\ to\ top\ wealth} \end{pmatrix}$$

Identification Matrix for Figure A9

$$\begin{pmatrix} e^{financial\ globalisation\ (KOF)} \\ e^{individual\ gov\ spending/GDP} \\ e^{real\ ICT\ capital\ intensity} \\ e^{union\ density\ or\ collective\ bargaining} \\ e^{top\ 1\%\ income\ share} \\ e^{top\ 1\%\ wealth\ share} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ b_1 & 1 & 0 & 0 & 0 & 0 \\ b_2 & b_3 & 1 & 0 & 0 & 0 \\ b_4 & b_5 & b_6 & 1 & 0 & 0 \\ b_7 & b_8 & b_9 & b_{10} & 1 & 0 \\ b_{11} & b_{12} & b_{13} & b_{14} & b_{15} & 1 \end{bmatrix} \begin{pmatrix} u_{0t}^{globalisation\ shock} \\ u_{1t}^{gov\ bargaining\ shock} \\ u_{2t}^{technology\ shock} \\ u_{3t}^{bargaining\ shock} \\ u_{4t}^{other\ shock\ to\ top\ income} \\ u_{5t}^{other\ shocks\ to\ top\ wealth} \end{pmatrix}$$

Identification Matrix for Figure A10

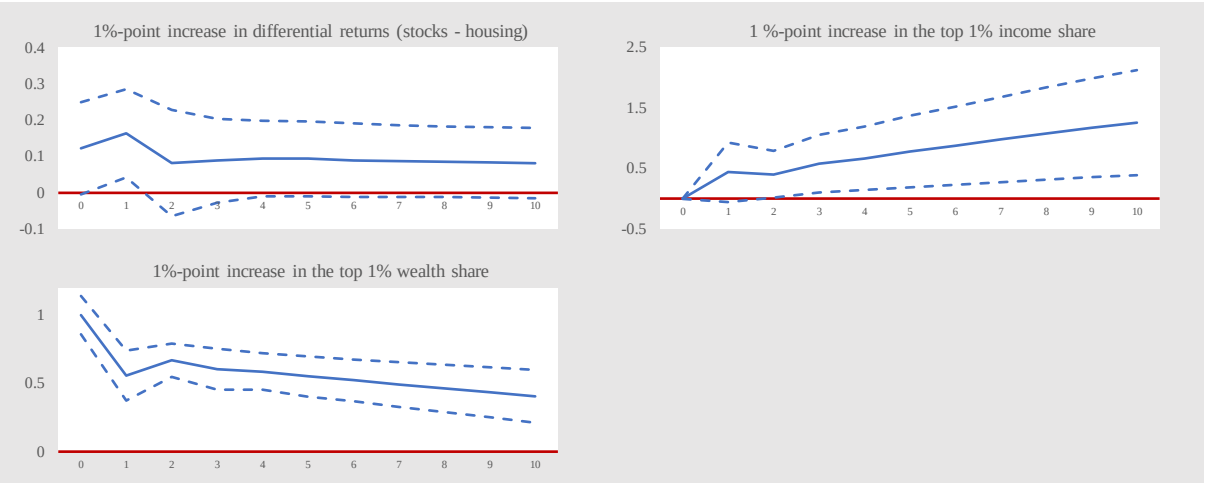
$$\begin{pmatrix} e^{financial\ globalisation\ (KOF)} \\ e^{real\ ICT\ capital\ intensity} \\ e^{union\ density\ or\ collective\ bargaining} \\ e^{top\ 1\%\ wealth\ share} \\ e^{top\ 1\%\ income\ share} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ b_1 & 1 & 0 & 0 & 0 & 0 \\ b_2 & b_3 & 1 & 0 & 0 & 0 \\ b_4 & b_5 & b_6 & 1 & 0 & 0 \\ b_7 & b_8 & b_9 & b_{10} & 1 & 0 \end{bmatrix} \begin{pmatrix} u_{0t}^{globalisation\ shock} \\ u_{1t}^{technology\ shock} \\ u_{2t}^{bargaining\ shock} \\ u_{3t}^{other\ shock\ to\ top\ wealth} \\ u_{4t}^{other\ shocks\ to\ top\ income} \end{pmatrix}$$

Identification Matrix for Figure A11

$$\begin{pmatrix} e^{financial\ globalisation\ (KOF)} \\ e^{real\ ICT\ capital\ intensity} \\ e^{net\ public\ wealth\ to\ national\ income} \\ e^{top\ 1\%\ wealth\ share} \\ e^{top\ 1\%\ income\ share} \end{pmatrix} = \begin{bmatrix} 1 & 0 & 0 & 0 & 0 & 0 \\ b_1 & 1 & 0 & 0 & 0 & 0 \\ b_2 & b_3 & 1 & 0 & 0 & 0 \\ b_4 & b_5 & b_6 & 1 & 0 & 0 \\ b_7 & b_8 & b_9 & b_{10} & 1 & 0 \end{bmatrix} \begin{pmatrix} u_{0t}^{globalisation\ shock} \\ u_{1t}^{technology\ shock} \\ u_{2t}^{public\ wealth\ shock} \\ u_{3t}^{other\ shock\ to\ top\ wealth} \\ u_{4t}^{other\ shocks\ to\ top\ income} \end{pmatrix}$$

Identification Matrix for Figure A12

UK



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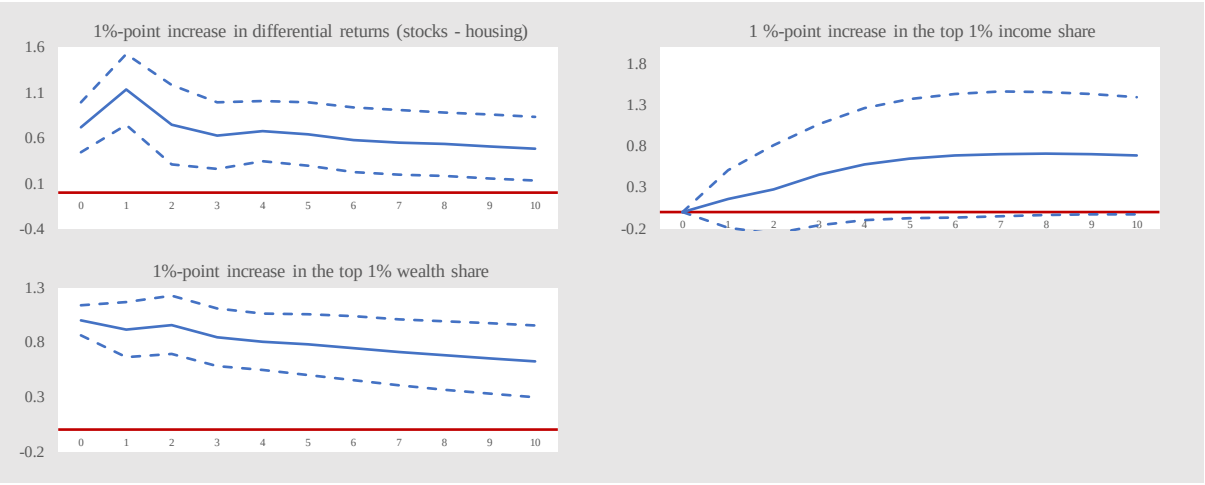

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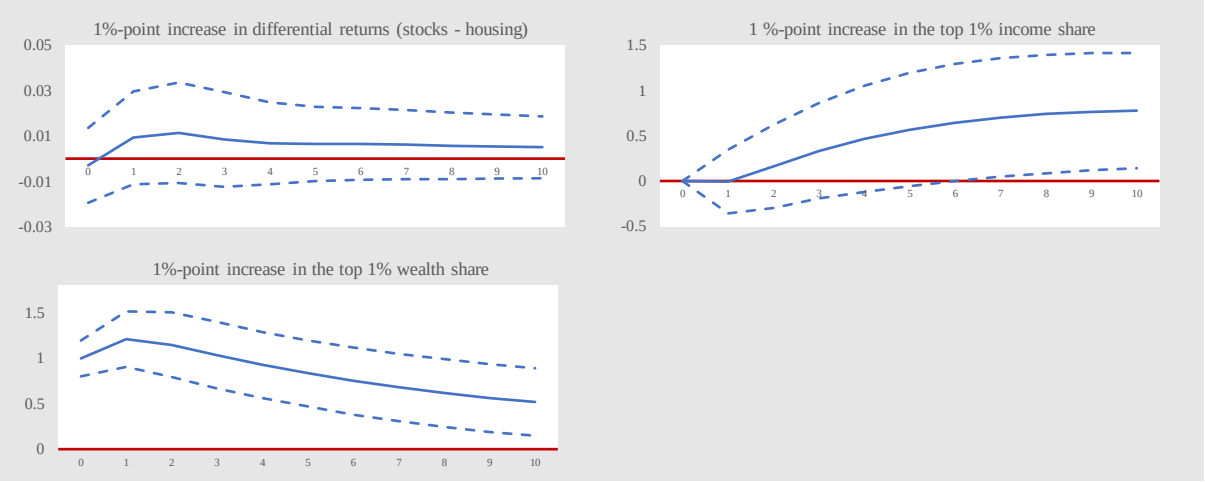
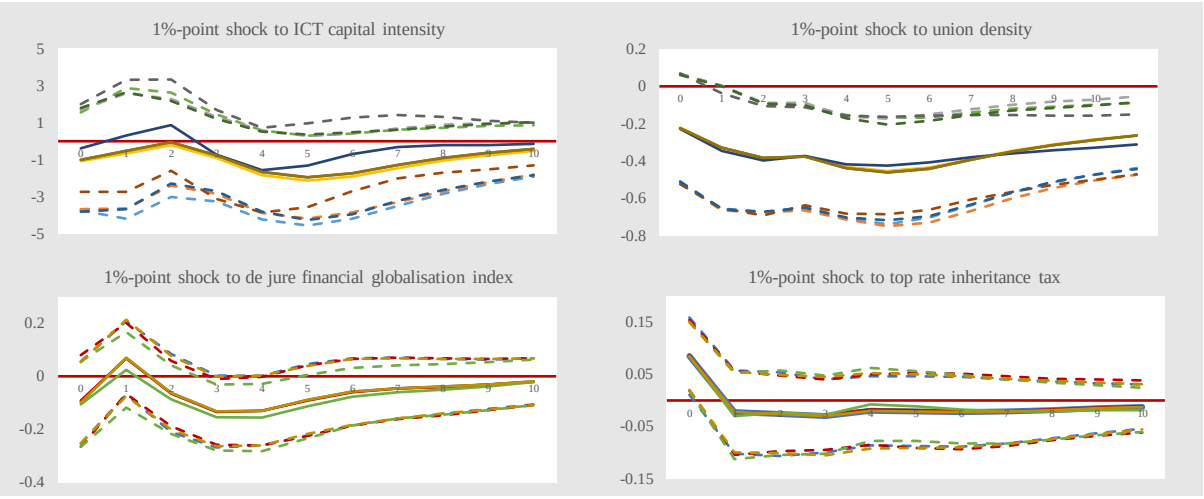


Figure A3. Orthogonalized impulse response function: effects of components of wealth on the top 1% wealth share years with wealth ordered after income

Notes: Sample: 1970-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: annual years / y axis: %-point change to the top 1% wealth share.

UK



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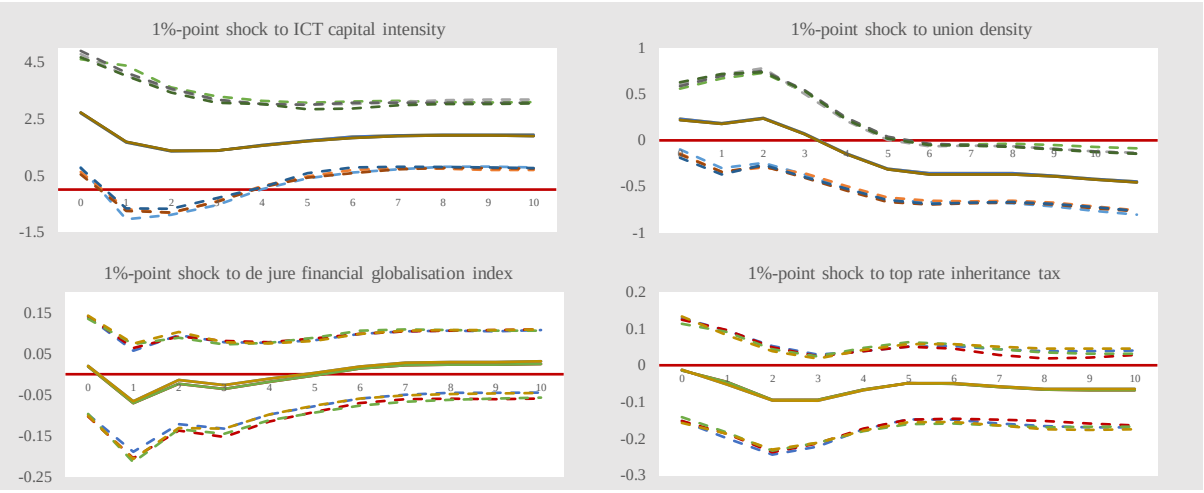

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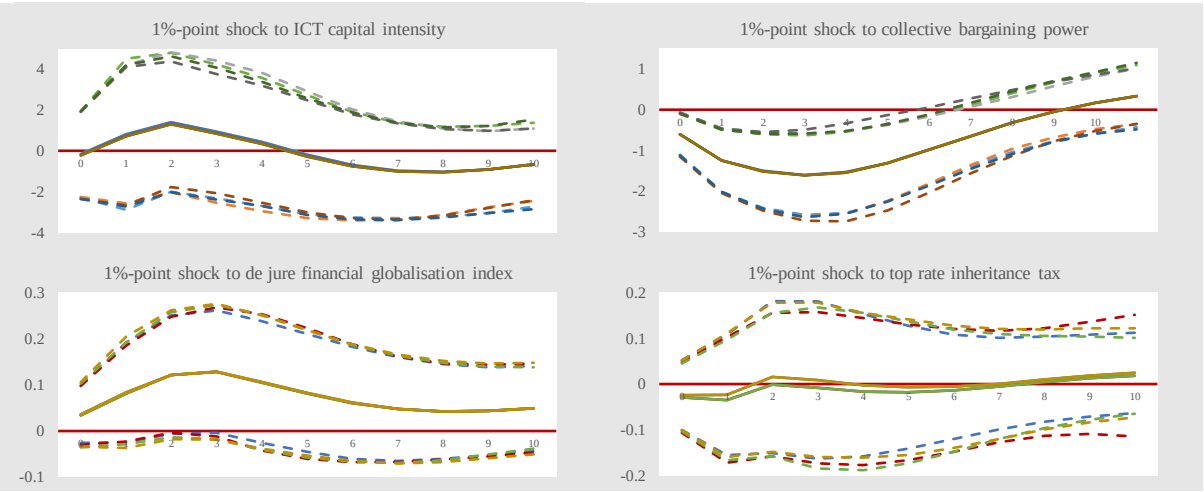
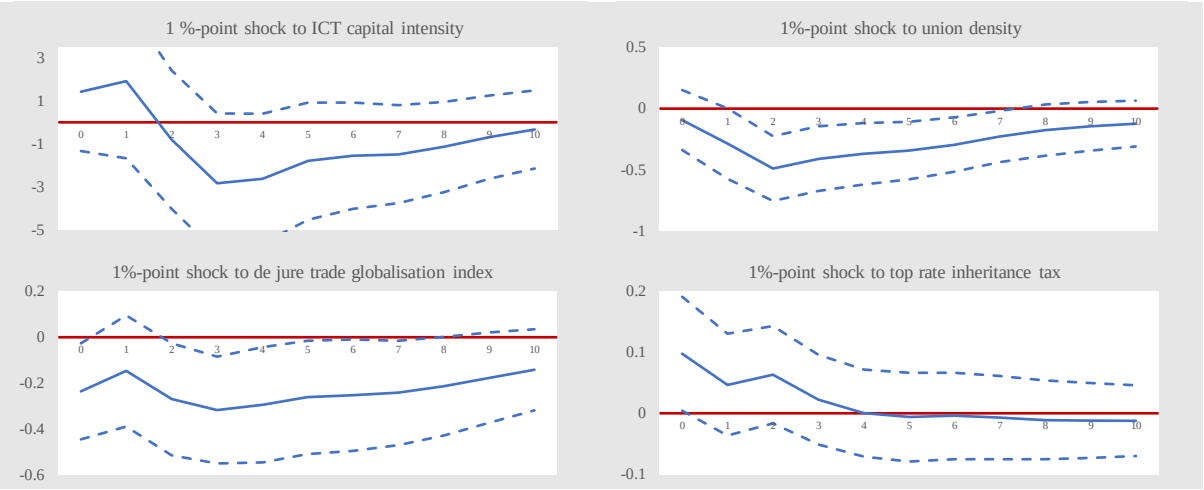


Figure A4. Orthogonalized impulse response function: effects of deep determinants on top 1% wealth share with alternative ordering of deep determinants

Notes: Sample: 1970-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: annual years / y axis: %-point change to the top 1% wealth share. The orderings of the variables (most exogenous, .. , most endoengous) are coloured according to the following codes:
Yellow: Globalisation, tax, technology, union
Green: Tax, globalisation, tech, union
Red: Globalisation, tax, union tech
Blue: Tax, globalisation, union tech

UK



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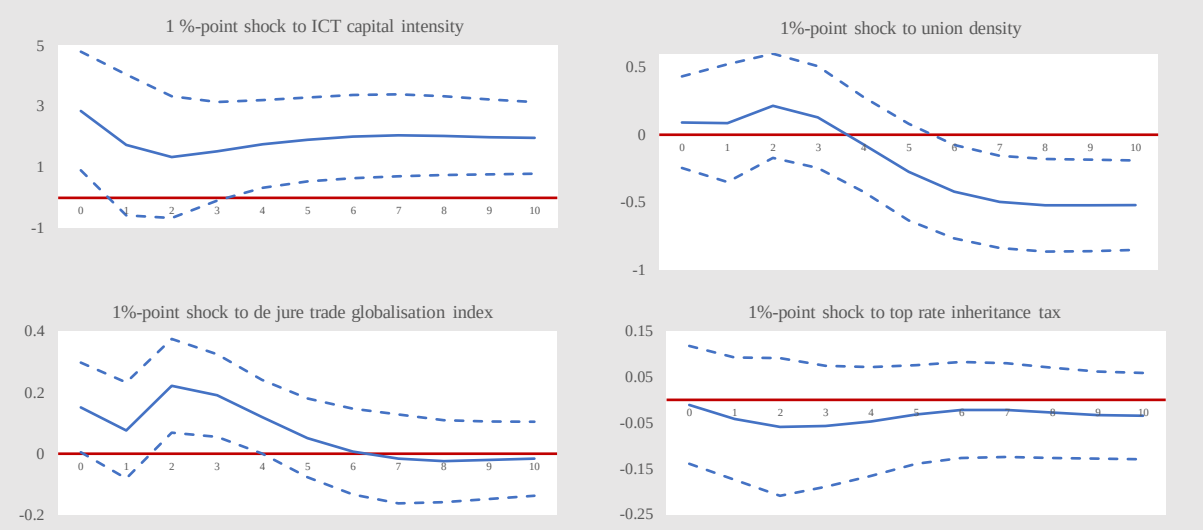

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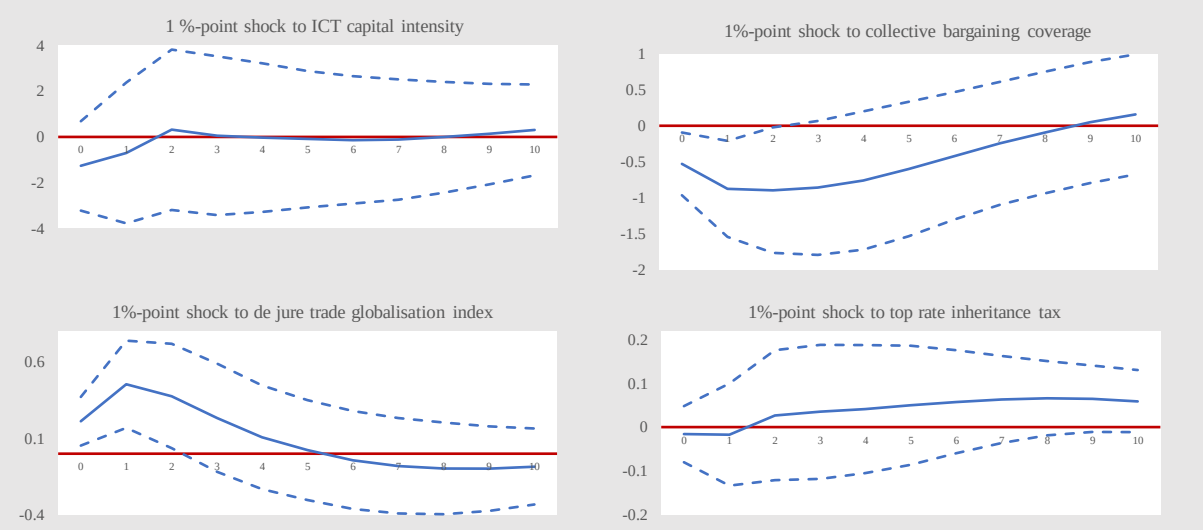
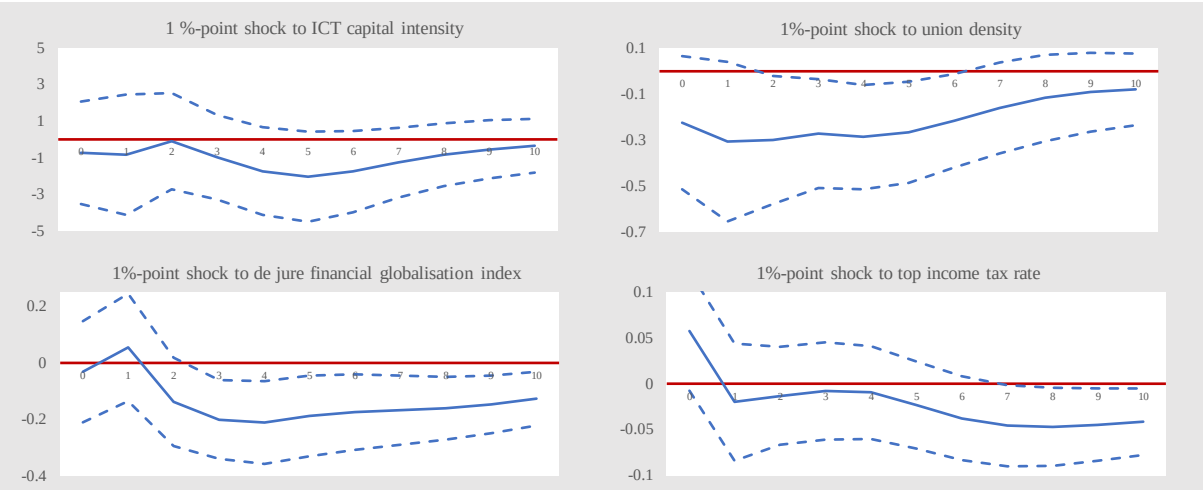


Figure A5. Orthogonalized impulse response function: effects of deep determinants with trade globalisation on the top 1% wealth share

Notes: Sample: 1970-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: annual years / y axis: %-point change to the top 1% wealth share.

UK



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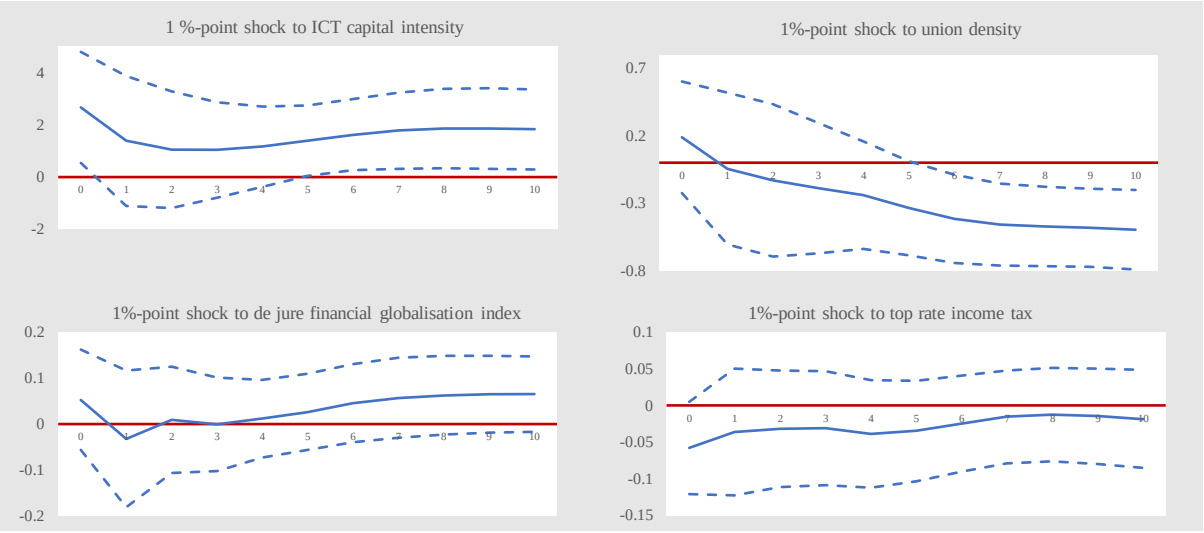

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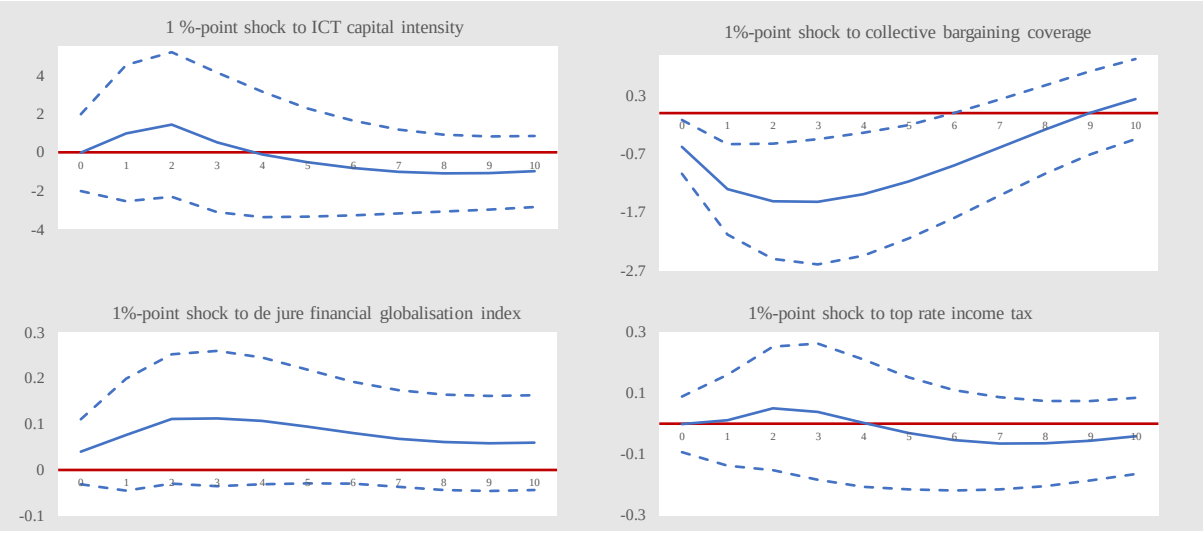
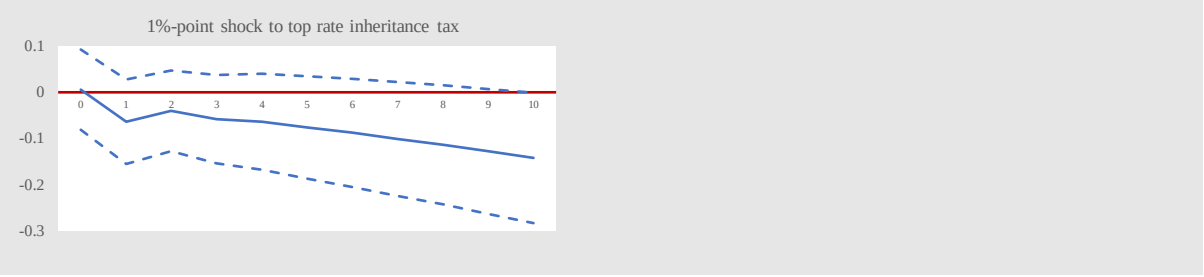


Figure A6. Orthogonalized impulse response function: effect of deep determinants with top income tax rate on the top 1% wealth share

Notes: Sample: 1970-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: annual years / y axis: %-point change to the top 1% wealth share.

UK



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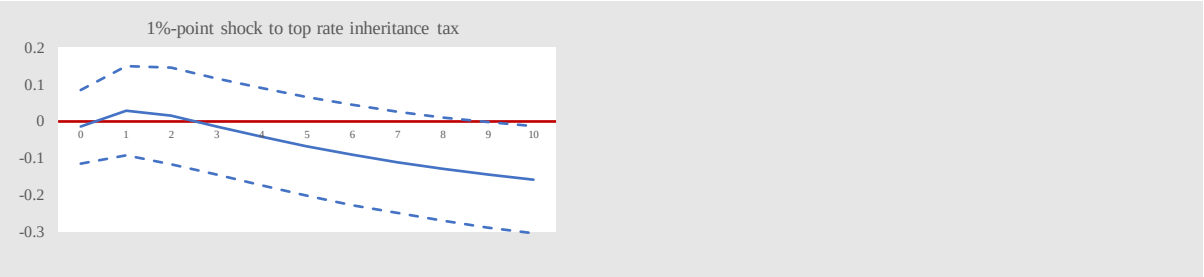

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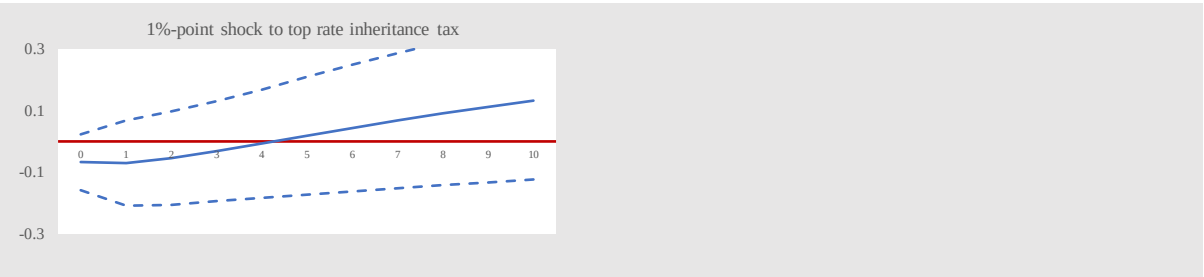
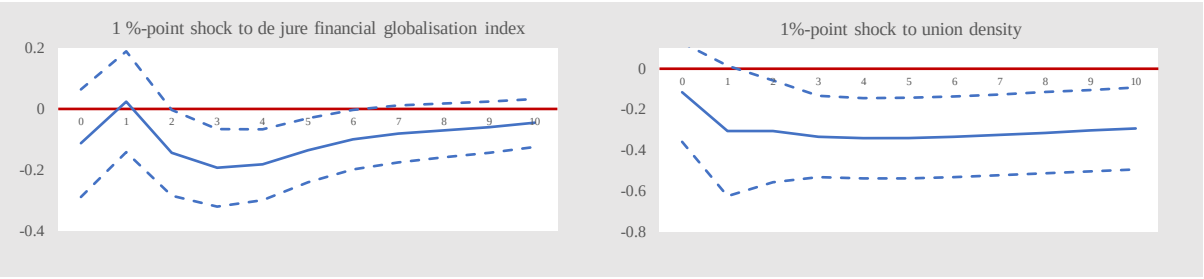


Figure A7. Orthogonalized impulse response function of institutional and structural variables on the top 1% wealth share with just inheritance tax rates

Notes: Sample: 1970-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: annual years / y axis: %-point change to the top 1% wealth share.

UK



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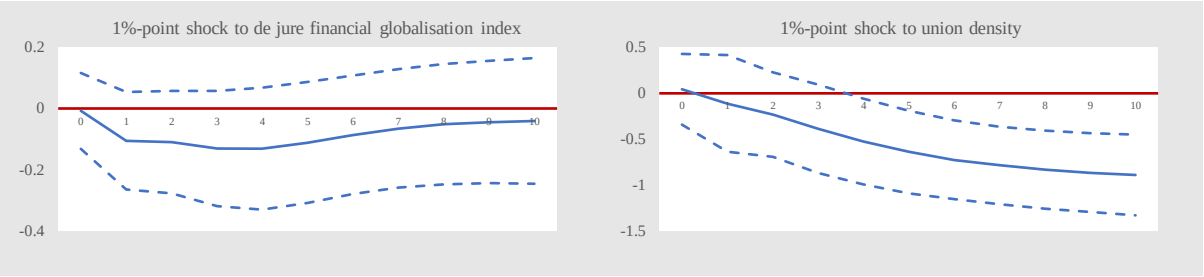

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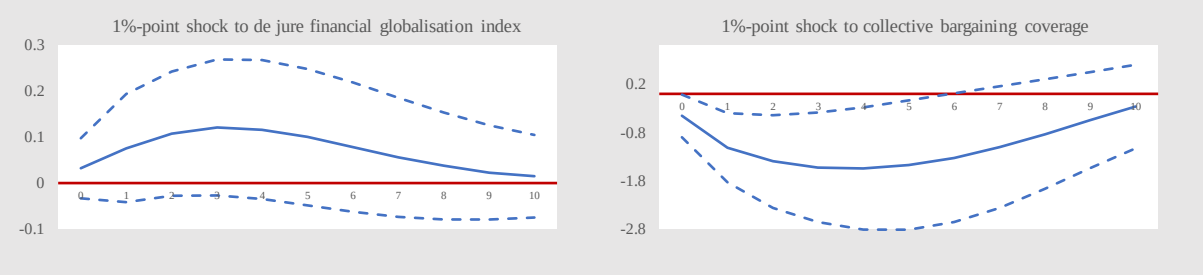
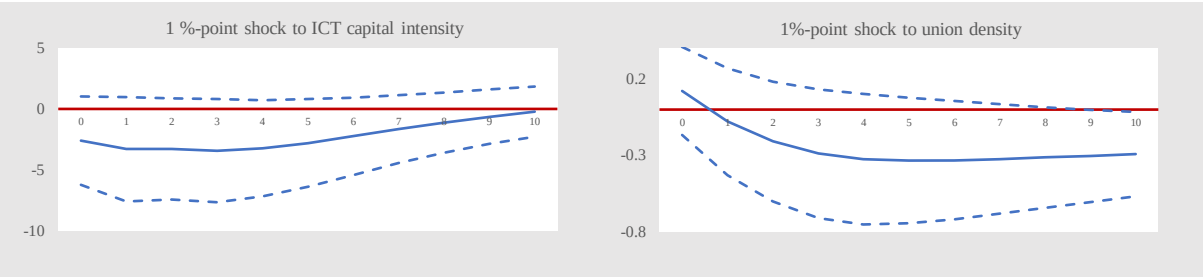


Figure A8. Orthogonalized impulse response function: effect of labour's bargaining power and globalisation on the top 1% wealth share

Notes: Sample: 1970-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: annual years / y axis: %-point change to the top 1% wealth share.

UK



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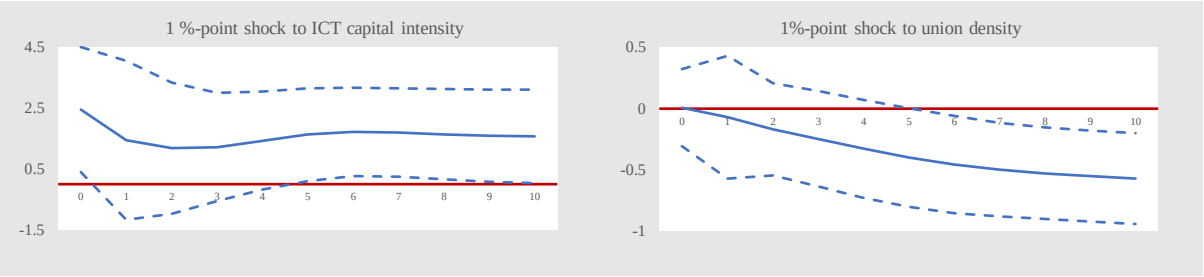

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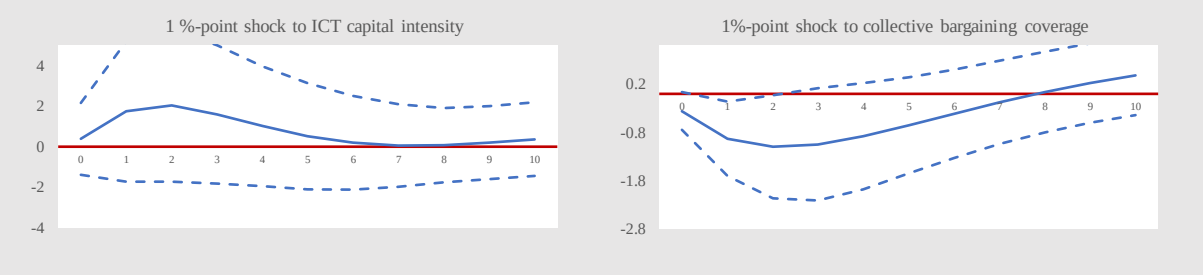


Figure A9. Orthogonalized impulse response function: effect of labour's bargaining power and technology on the top 1% wealth share

Notes: Sample: 1970-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: annual years / y axis: %-point change to the top 1% wealth share.

USA

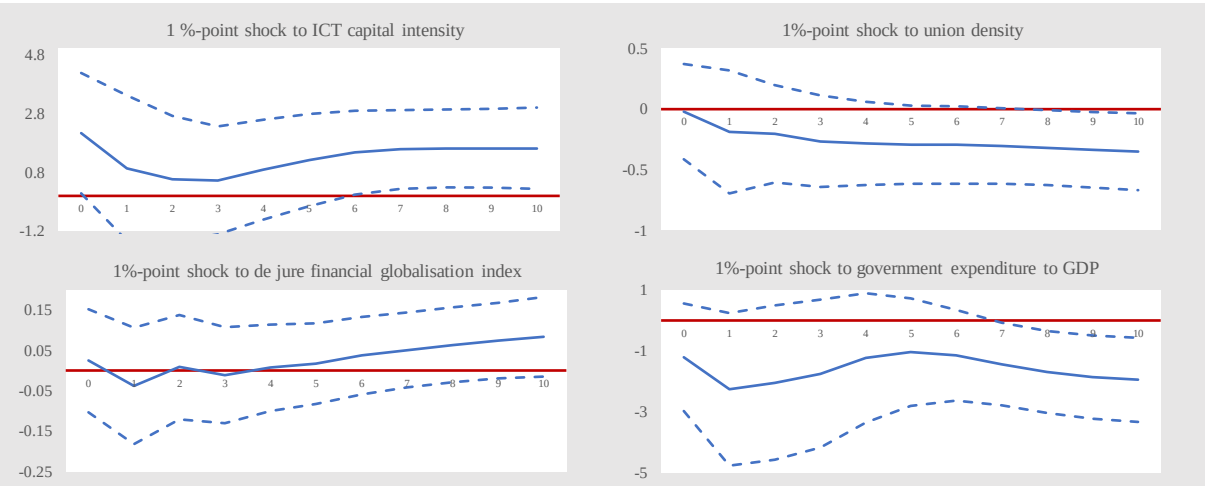
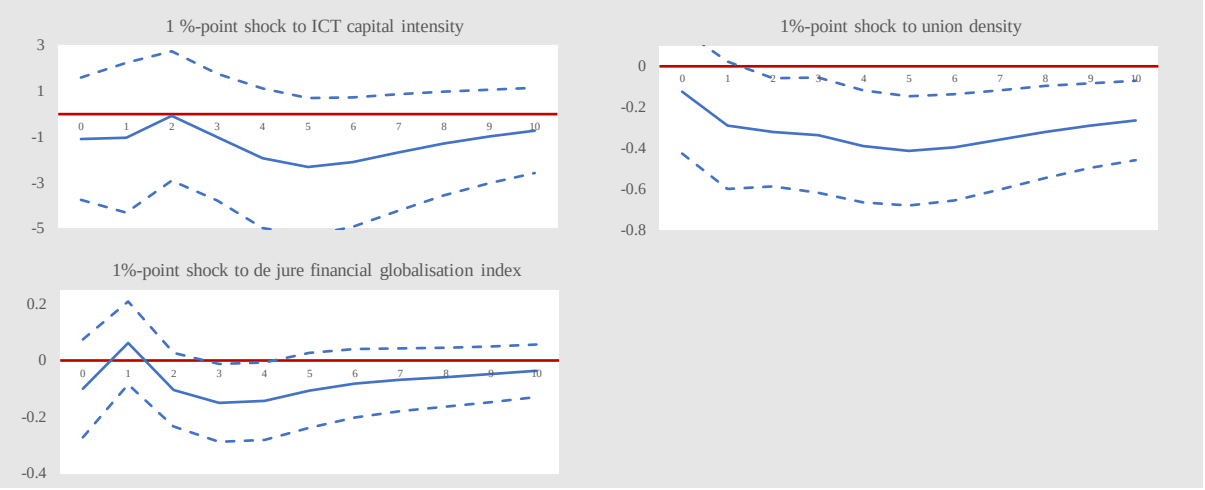


Figure A10. Orthogonalized impulse response function: effects of deep determinants on the top 1% wealth share with government spending on individuals to GDP.

Notes: Sample: 1970-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: annual years / y axis: %-point change to the top 1% wealth share.

UK



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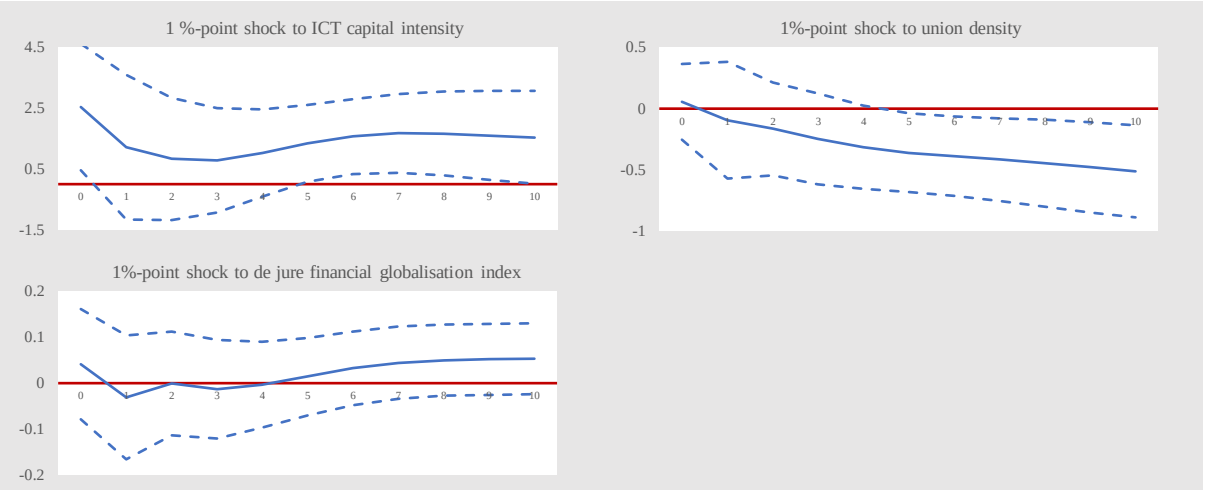

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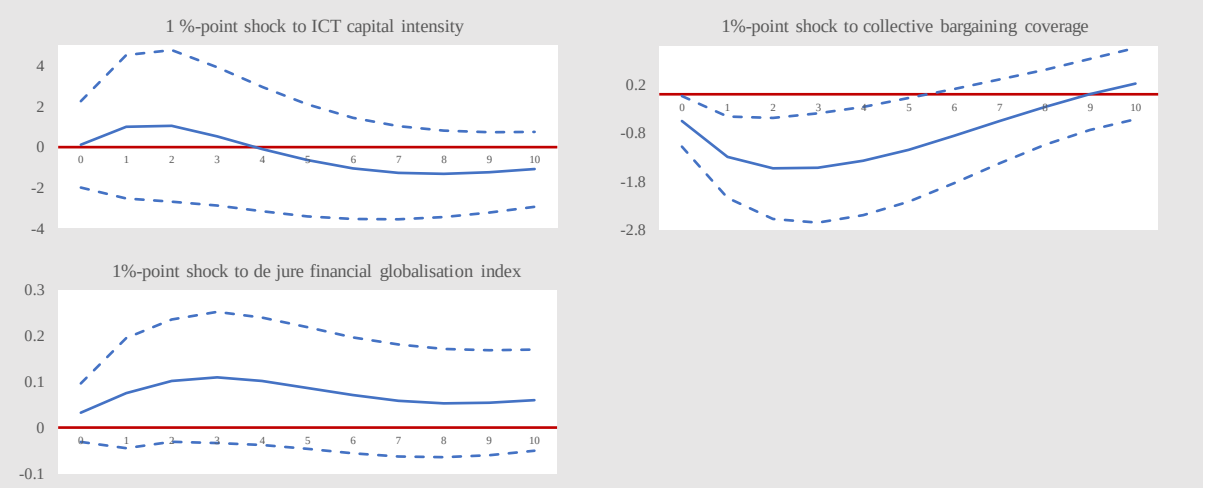
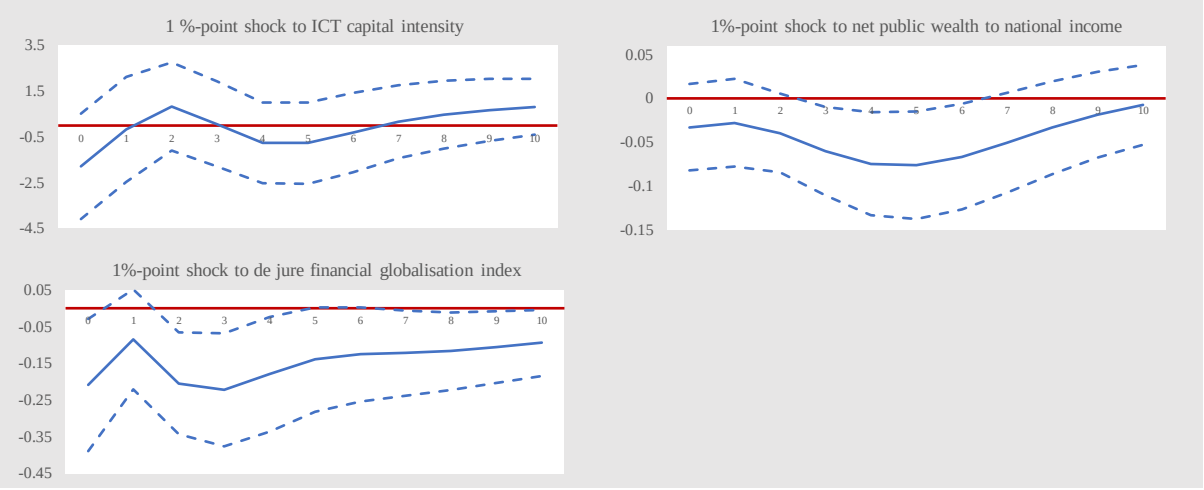


Figure A11. Orthogonalized impulse response function: effect of labour's bargaining power, technology, globalisation on the top 1% wealth share

Notes: Sample: 1970-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: annual years / y axis: %-point change to the top 1% wealth share.

UK



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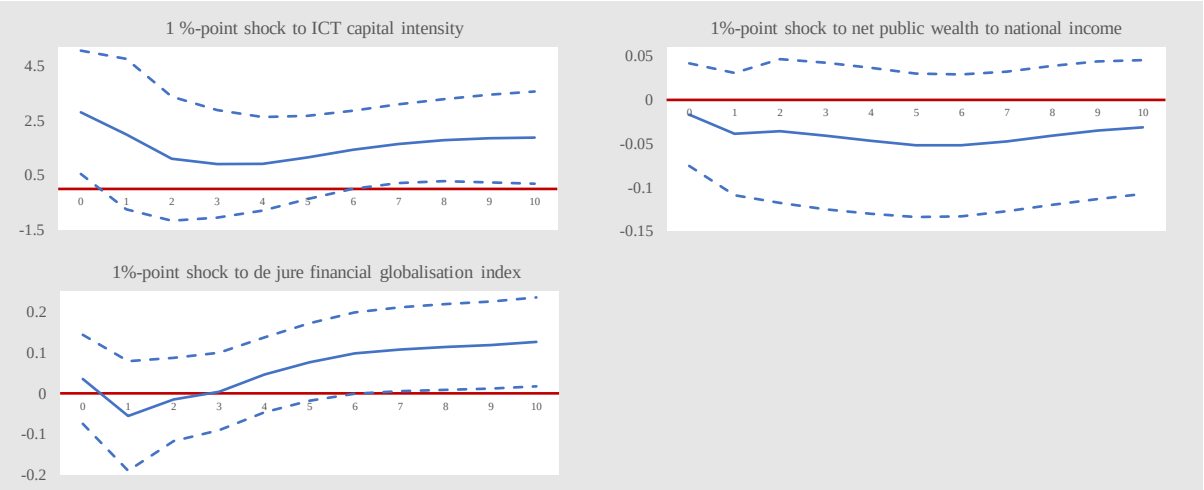

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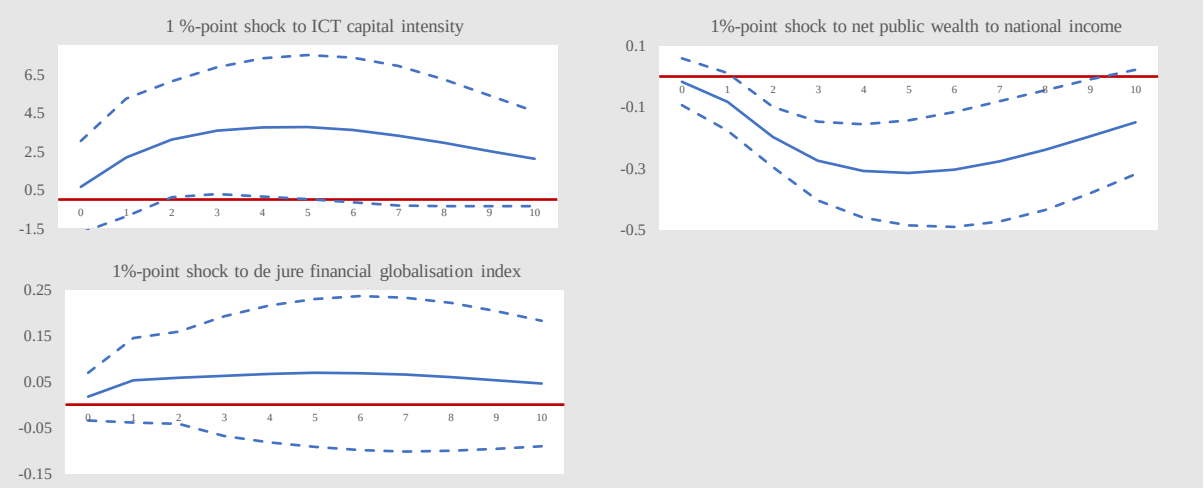

Figure A12. Orthogonalized impulse response function: effect of net public wealth, technology, globalisation on the top 1% wealth share

Notes: Sample: 1970-2014. Solid blue line: orthogonalized impulse response function. Blue dotted line: the residual-based 95% level bootstrapped confidence intervals. Legend: x axis: annual years / y axis: %-point change to the top 1% wealth share.