The Impact of Fiscal Policy, Income and Wealth Inequality, Financialization and the Housing Market on Growth

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Abstract

We develop a consolidated neo-Kaleckian model of an open economy with government which integrates financialisation and wealth effects. We start from the Bhaduri and Marglin (1990) model and introduce a government sector, integrating tax rates on labour income, profits, wealth and consumption, government investment and government consumption, and government debt. We expand the model to integrate wealth effects on consumption and investment, distinguishing between the wealth of the bottom 99% and the top 1% in order to capture the effect of rising wealth concentration.

Financialisation can manifest itself in different forms. One well-documented symptom of financialized economies is shareholder value reorientation. In our model, this will take the form of rising net dividend payments to shareholders that leave a smaller share of profits available for reinvestment. We capture this by integrating a rentier profit share alongside a non-rentier profit share. Another form of shareholder value reorientation is the increase in share buy-backs which can push stock prices upwards. Such an effect will be captured by integrating stock prices and the value of financial assets into our model. Secondly, financialisation is also associated with property price inflation and property bubbles. We capture these by including property prices into our model.

The model has three contributions. The first is that we develop separate equations for household and corporate investment. Recognizing that household investment is not profit driven, we model it in a consumption-like manner. Corporate investment is modelled building on Bhaduri and Marglin (1990), adding wealth and financialization effects. This is an important contribution, given that the effect of income distribution on investment was empirically found to be insignificant or counter-intuitive in some of the studies we reviewed. Modelling the two types of investment separately allows us to correctly and categorically determine these effects. The second innovation is that the model allows us to capture the channels through which stock and property bubbles can affect aggregate demand. These do not have direct effects on consumption and investment. Instead, rising stock and property prices inflate the value of wealth and can increase wealth concentration. We therefore develop two additional equations for the stock of net wealth and the net wealth concentration ratio. Rising wealth and wealth concentration, in turn, affects consumption and investment. Third, our net export specification allows for an increasing marginal propensity to import across the income and wealth distribution.

The model is estimated empirically on the UK using quarterly data from 1987 to 2017.

Introduction

In the short time span of just three decades, the UK economy has experienced two recessions, the 1991-1992 UK recession and the 2008-2009 Great Recession, the boom and bust of the 2000 technology bubble and a housing bubble which burst in the financial crisis of 2007-2008. The period between 1987-2017 has been characterized by historically slow economic growth and low investment levels. Pre-tax distributional dynamics have been fairly stable throughout the period, with the exception of a one-off increase in the wage share following the introduction of the national minimum wage in 1998. However, fiscal policy has played a key role in propping up profits, as implicit taxes on capital income went down, particularly as an answer to the two recession episodes. The reverse of the coin has been constrained government expenditures during those periods. In order to assess the success or failure of this strategy, we must first identify the type of demand regime for the period. The question becomes more challenging as several other factors, namely financialisation and wealth concentration, have come into play.

Financialisation is defined as "the increasing role of financial motives, financial markets, financial actors and financial institutions in the operation of the domestic and international economies" (Epstein, 2005, p. 3). Financialisation within the household sector generally entails higher levels of household indebtedness, with credit being used either to finance consumption or the purchase of housing assets. From this point of view, it could lead to an overheating of the economy or to housing bubbles, with negative effects on economic stability. In the corporate sector, firms reorient from long term investment motives to shareholder value maximization. Within non-financial corporations, this can become visible in the form of expanding financial operations, financial assets and financial profits, as well as share buy-backs (Lazonick and O'Sullivan, 2000). This can have important implications for economic growth if firms are incentivised to accumulate financial assets rather than fixed capital. Stockhammer (2004) also points out that financialisation can translate into higher dividend payments of non-financial corporations, at the expense of retained profits. Lastly, financialisation is also present within the government sector. As Karwowski and Centurion-Vicencio (2018) point out, increasingly, public services become the basis for the development of new financial assets and public debt is tradeable on secondary markets. Some of these effects have already become visible in the UK economy through asset bubbles, debt accumulation and shareholder value orientation, translated into higher net dividend payments of non-financial corporations.

The third area of interest is that of wealth dynamics. Piketty's resounding work Capital in the Twenty-first Century (2014) has brought renewed attention to the topic. In the UK, net wealth has surged in value, largely as a result of asset price inflation, but it has also become more concentrated at the top, with the top 1% now owning nearly 24% of total net wealth.

Against this backdrop, we develop a general integrated macroeconomic demand and distribution model, which draws on the Post-Keynesian economic literature. The model goes beyond existing simplifications by introducing a detailed government sector, financialisation considerations and wealth concentration effects in a neo-Kaleckian open-economy framework. We aim to test the model empirically for the UK for the period under consideration. We pose the following research questions: i. what are the effects of

changes in fiscal policy on aggregate demand?; ii. what are the drivers of private investment?; iii. what is the effect of higher dividend payments of non-financial corporations on investment and aggregate demand?; iv. what is the effect of rising wealth concentration on aggregate demand?; v. what is the channel through which stock and property bubbles impact aggregate demand, and what is their effect on wealth accumulation and concentration?.

The main features of the model are the following: i. the government sector is integrated by considering the after-tax distribution of income and wealth, government consumption expenditure and government investment effects, as well as government debt effects on private investment; ii. we distinguish between household investment and corporate investment, proposing that the former behaves in a consumption-like manner, while the latter is an extension of the Bhaduri and Marglin's (1990) specification; iii. we allow for different wealth effects for the top 1% and the bottom 99% of the wealth distribution on consumption, investment and imports; iv. we integrate financialisation effects at the level of non-financial corporations by separating net dividends paid by non-financial corporations from the rest of profits, and treating the former as "rentier profits"; v. we integrate financialisation effects in asset markets by considering the effects of share and house price inflation on the value of net wealth and on the net wealth concentration ratio.

Our model has three contributions. The first is that we develop separate equations for household and corporate investment. To the best of our knowledge, this has not been done previously, despite the fact that some studies have arrived at empirically conflicting results. We hope that our method will help clarify the profit-led character of private corporate investment, as opposed to the wage-led character of household investment. The second innovation is that the model allows us to capture the channels through which stock and property bubbles can affect aggregate demand. We argue that these do not have direct effects on consumption and investment. Instead, rising stock and property prices inflate the value of wealth and can increase wealth concentration. Rising wealth and wealth concentration, in turn, affect consumption and investment. Third, our net export specification allows us to test for an increasing marginal propensity to import across the income and wealth distribution.

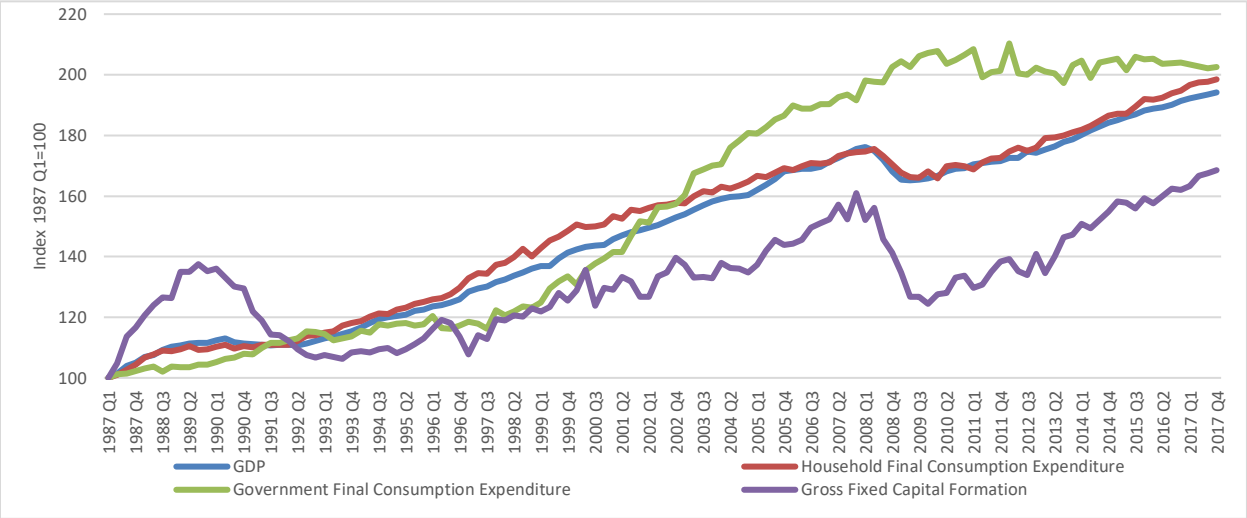
This paper is structured as follows: section 1 is a detailed description of the main data issues, data sources and macroeconomic developments in the UK during the last three decades; section 2 provides a survey of the recent Post-Keynesian literature, placing particular emphasis on how the government sector, financialisation effects and wealth have been integrated in Post-Keynesian models; section 3 outlines the theoretical model; section 4 presents methodology and estimation results.

1. Data and Stylised facts

This section provides a descriptive overview of the evolution of the UK economy in the past three decades, from 1987 to 2017. This interval covers two recession episodes: the 1991-1992 UK recession and the 2008-2009 Great Recession, as well as the boom and bust of the 2000 dot-com bubble and the housing bubble which burst in the financial crisis of 2007-2008. Overall, the period has been characterized by slow economic growth and low investment levels. From a distributional perspective, labour compensation has risen faster than GDP, but the corresponding slowdown in profit growth has been mitigated through cuts in taxes on capital income. A worrying development has been the dramatic increase in wealth concentration. Lastly, financialisation effects become visible through asset price inflation, debt accumulation and shareholder value reorientation translated into higher dividend payouts of non-financial corporations. A detailed description of all these developments will be provided bellow. A list of variable names and descriptions can be found in Appendix 1 and a list of descriptive statistics can be found in Appendix 2.

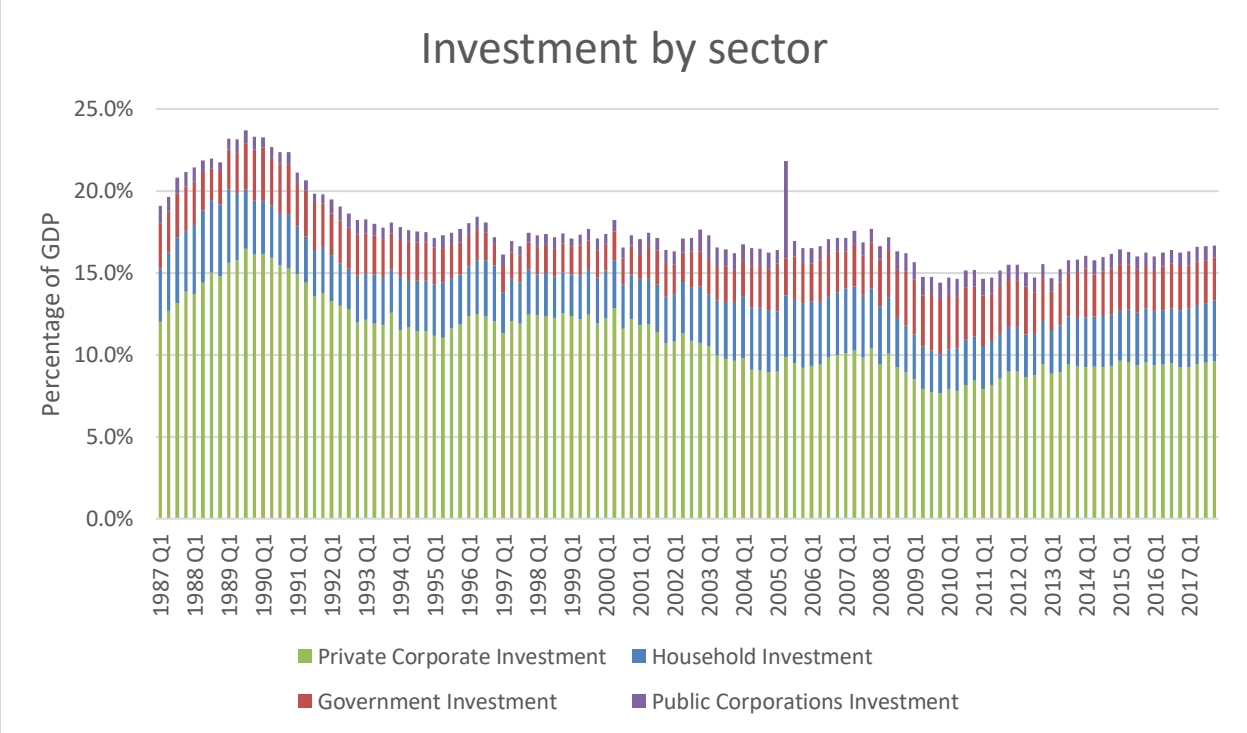
Figure 1 indicates the quarterly evolution of real GDP and aggregate demand components between 1987 and 2017. Average economic growth for the period stands at just 2.1% per year, given that the interval covers the 1991-1992 recession and the Great Recession of 2008-2009. By comparison, real household final consumption increased only slightly more, by 2.2% per year on average, growing faster than GDP throughout the 1990s, then slowing down and picking up some momentum again after 2012. Real government final consumption expenditure doubled between 1987 and 2009, growing at 3.2% per year on average, but then stalled. Real investment has been more volatile and has overall lagged behind, increasing at an annual average growth rate of 1.4% between 1987 and 2017. This is due to sluggish private corporate investment growing just 1% per year on average, while government and household investment rose in line with GDP. As a share of GDP, total investment has fallen from a maximum of 23% in 1989 to under 17% in 2017, with private corporate investment steadily decreasing from over 16% to under 10% (Figure 2). Household investment as a share of GDP has had a particularly pro-cyclical evolution, peaking at around 4.5% prior to the 1991-1992 recession, reducing afterwards, but rebounding towards 4% of GDP in the lead-up to the financial crisis of 2007-2008.

Figure 1 GDP and main expenditure aggregates



Source: ONS UKEA dataset

Figure 2 Investment by sector



Source: ONS UKEA dataset

Notes: The 2005 Q2 spike in investment by public corporations is due to the transfer of nuclear reactors at the end of their production lives from the public corporation British Nuclear Fuels Ltd (BNFL) to the government body Nuclear Decommissioning Authority (NDA). The value of the transfer is £-15.6 billion, reflecting the large decommissioning and clean-up costs which were shifted to the NDA. For more information, please visit: https://www.ons.gov.uk/economy/grossdomesticproductgdp/bulletins/businessinvestment/2015-09-30

From an income perspective, pre-tax and after-tax labour compensation has increased at the same rate, since the implicit tax rate on labour changed very little during the whole period, remaining at around 25% (Figure 5). Overall, the wage share has seen a one-off increase after the introduction of the National Minimum Wage Act in 1998, stabilizing at around 60% of GDP, at factor cost, following 2000. This corresponds to an increase of 4.5 percentage points in the wage share between 1987 and 2017 (Figure 3). However, from a historical perspective, the wage share has been on a decreasing trend ever since 1948 when records started, having lost over 10 percentage points in the past seven decades (Figure 4).

On the other hand, the profit share has recorded an equal decline of 4.5 percentage points of GDP at factor cost between 1987 and 2017. However, the decline in the profit share has been entirely compensated by a reduction in taxation: the after-tax profit share actually increased by 1.5 percentage points (Figure 3). Real after-tax profits have risen particularly fast after the two recession episodes: between 1992-1997 and after 2009, driven by the reduction in the implicit tax rate on capital income, which reached a maximum of over 41% in 1991, but was just 24.5% by 2017, 11 percentage points lower than in 1987. The 1992-1997 and post-2009 after-tax profit expansions were possible due to particularly sharp tax cuts on capital income during these periods (Figure 5). Simultaneously, they were accompanied by sluggish or stagnating government expenditures (Figures 1 and 2), in an attempt to bring down government deficits (Figure 6).

Government debt as a percentage of GDP skyrocketed in the aftermath of the financial crisis when budget deficits reached over 10% of GDP (Figure 4). After 2012-2013, government debt appears to have stabilized, in the context of already stagnating government expenditures and reductions in government deficits.

Figure 4 Pre-tax and after-tax wage and profit shares

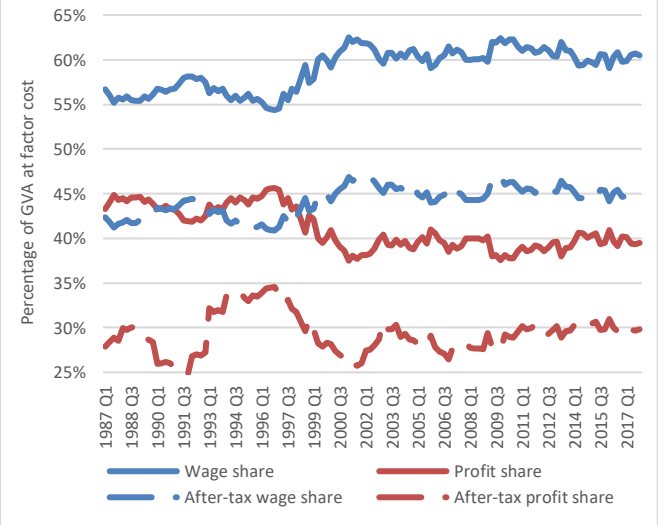
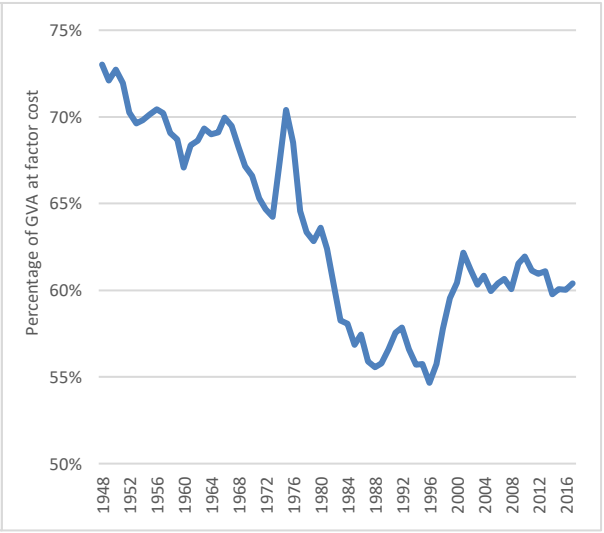
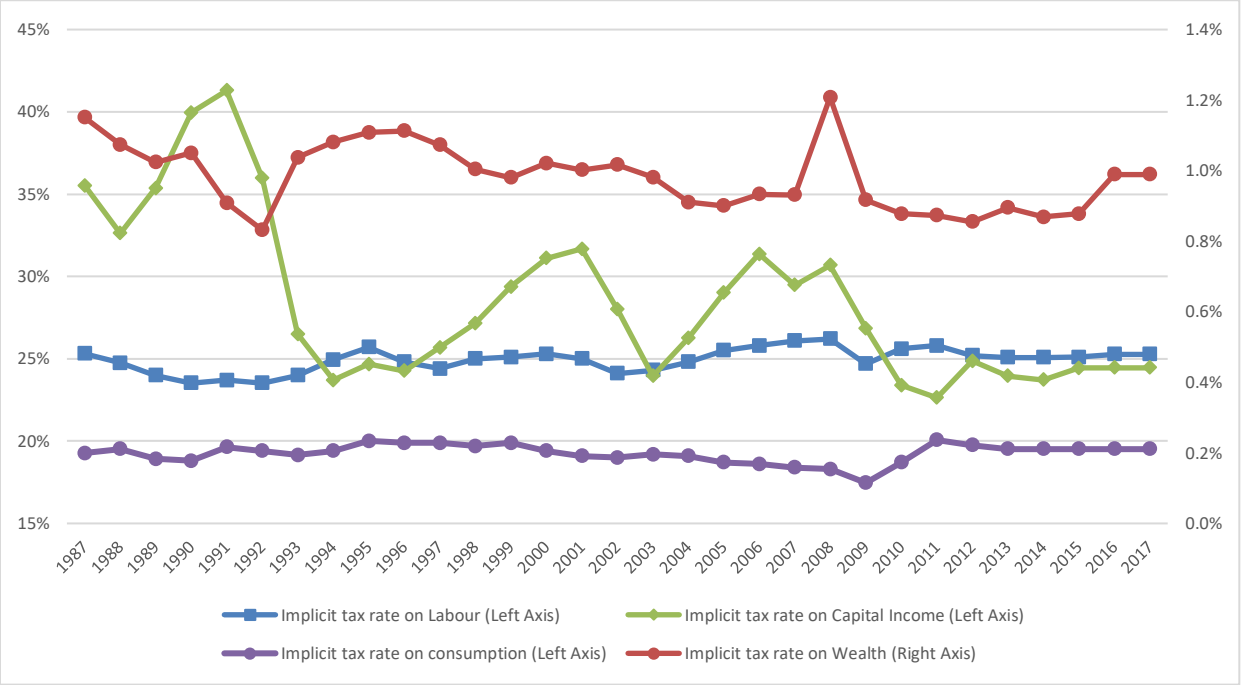


Figure 3 The adjusted wage share in historical perspective



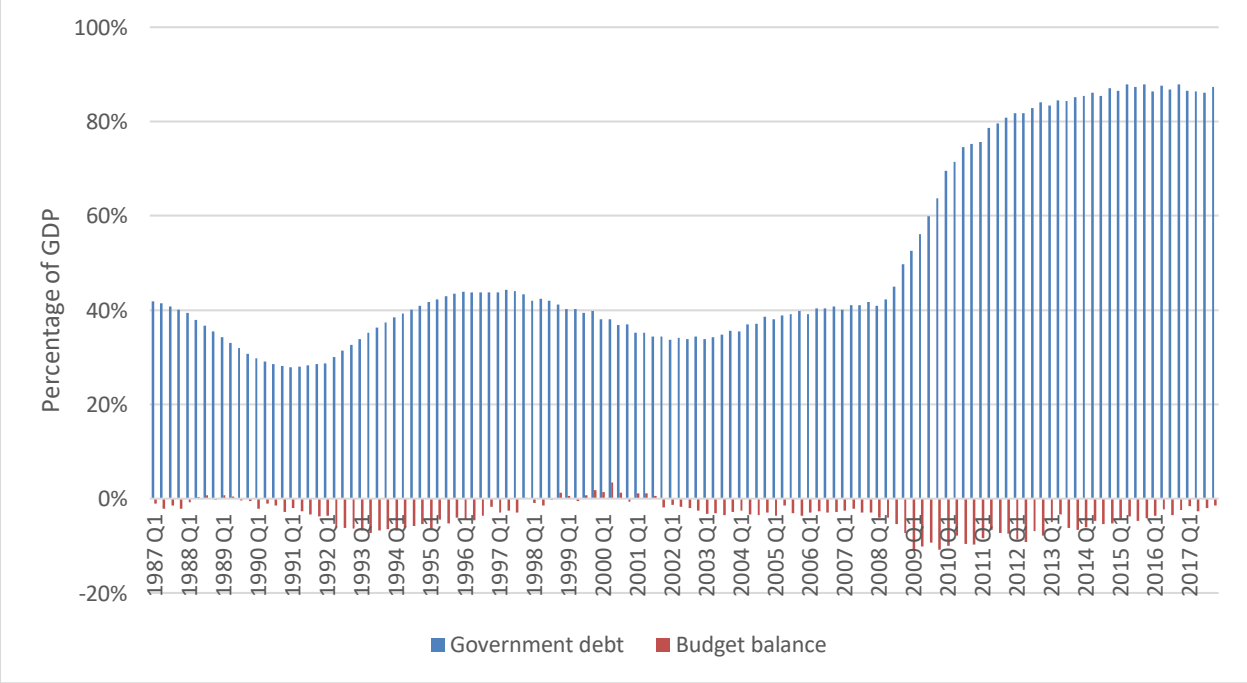
Source: ONS UKEA dataset and author's calculation.

Figure 5 Implicit tax rates in the UK



Source: Eurostat, European Commision "Taxation Trends" Reports and author's calculation

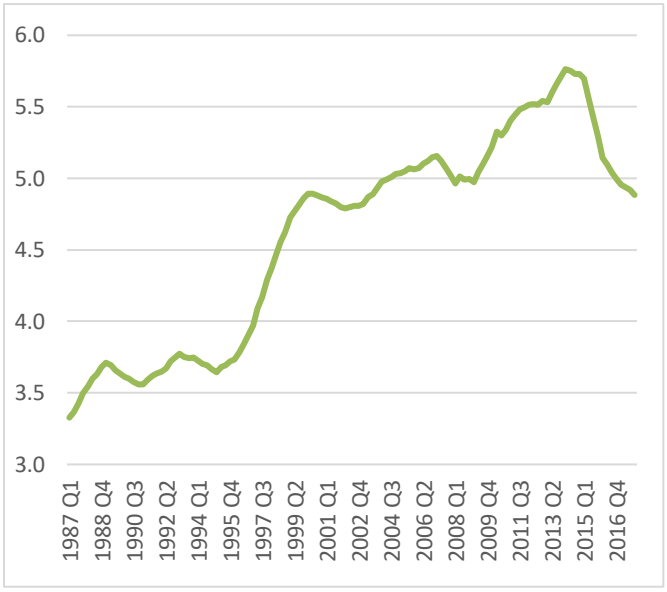
Figure 6 General Government debt and budget balance



Source: ONS UKEA dataset

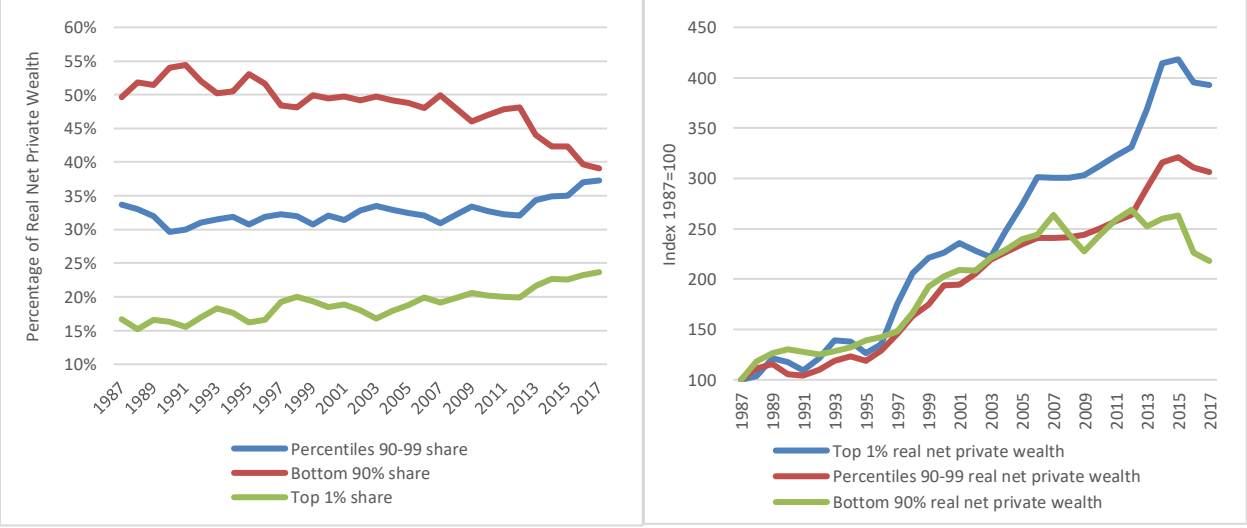
Another important development throughout the past three decades has been a steady increase in wealth and wealth concentration. Total real wealth net of debt has nearly tripled since 1987. To put this into perspective, the ratio of net wealth-to-GDP at factor cost has risen from 3.3 in 1987 to a maximum of 5.7 by 2014, then decreasing to 5 by 2017 (Figure 7). The net wealth of the top 1% increased four-fold over the past three decades, that of the 90-99 percentiles tripled, while the real net wealth of the bottom 90% doubled. As a result, wealth concentration, which we define as the share of net wealth owned at the top of the distribution - in this case, the top 1% - has increased from 16% in 1987 to 24% in 2017. The share owned by the following 9 percentiles increased from around 33% to 37%, while that of the bottom 90% decreased from over 50% to under 40%, most of the fall occurring after 2007 (Figure 8). From a historical perspective, wealth concentration has been on a decreasing trend since the start of the 20th century and until the early 1990s. Despite recent increases, wealth concentration is still well below their maximum, when the top 1% owned more than 70% of all net wealth and the bottom 90% of the distribution owned under 10%.

Figure 7 Ratio of net wealth-to-GDP at factor cost



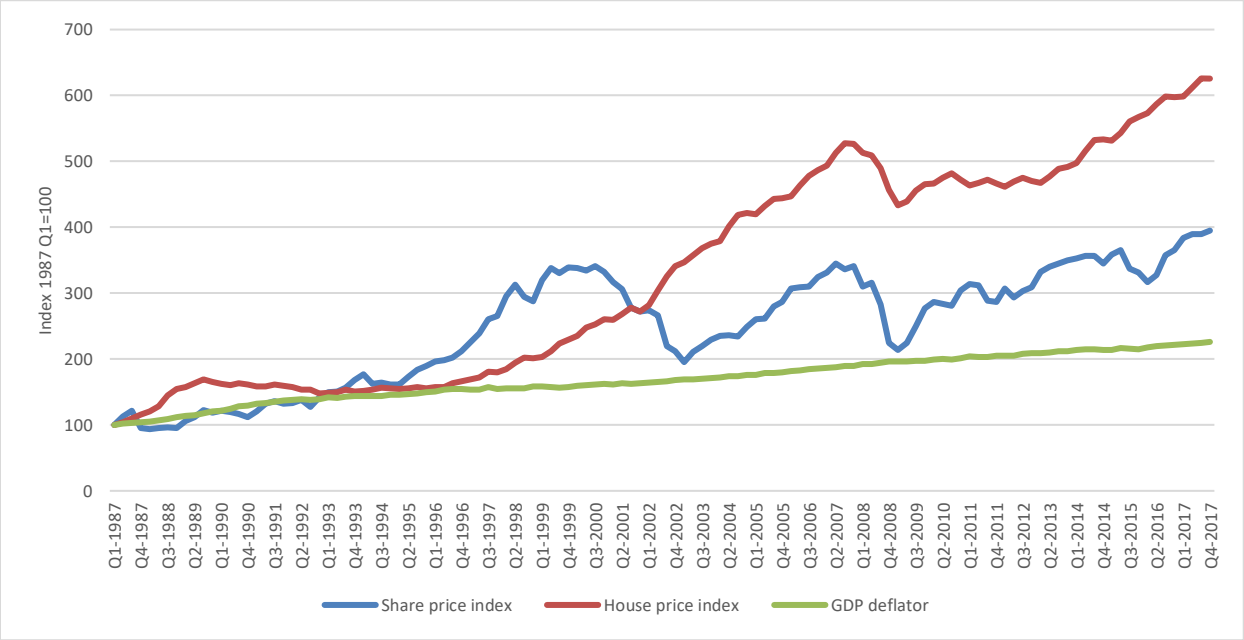
Source: WID database, Credit Suisse Research Institute Global Wealth Reports and author's calculation

Figure 8 The distribution of real net private wealth



Source: WID database, Credit Suisse Research Institute's Global Wealth Report and author's calculation

Figure 9 Nominal share and house price indices and the GDP deflator



Source: OECD, GOV.UK, ONS

The massive appreciation in the value of net wealth since the 1990s was made possible through asset price inflation. Figure 9 shows the nominal house and share price indices, in comparison with the GDP deflator. In the past three decades, the value of the UK share price index has quadrupled, while the house price index has increased six-fold. The inflation in asset prices was clearly driven by stock and property market bubbles. Share prices rose dramatically in the build-up of the dot-com bubble, plummeting after it burst, then picking up once again prior to the financial crisis and crashing down in 2008. They have been on an increasing path since 2009, surpassing their previous maximum. House prices rose continuously for an entire decade prior to the financial crisis, collapsing in 2008, as housing bubbles across the world burst. After a brief stagnation period, they began steadily picking up once more starting in 2013.

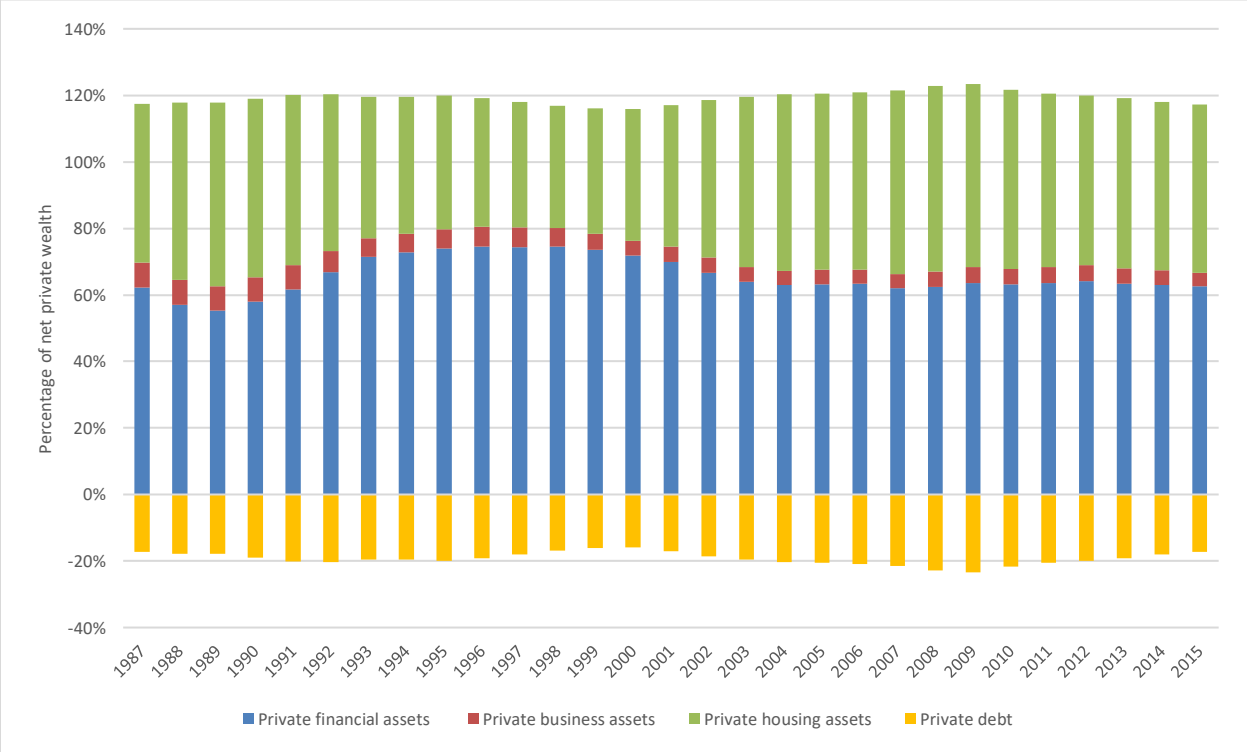
The composition of net wealth has also changed significantly in the past three decades. The process of financialisation of the UK economy can, to a large extent, explain these shifts. Financialisation is associated with asset price inflation, more frequent and more severe episodes of boom and bust both in financial and property markets. For households, financialisation allows for higher levels of indebtedness, which in turn enabled the build-up of the housing boom. As we will point out, changes in the structure of wealth mimic the episodes of asset price inflation presented above and follow the boom-bust scenario.

As indicated in Figure 10, the share of financial assets in total net wealth increased from a minimum of 55% in 1989 to 75% in 1998, as stock prices rose much faster than house prices during that period. After the burst of the dot-com bubble, their share has come down and stabilized at around 63%. The share of private housing assets has increased from a minimum of 38% in 1998-1999 to 56% in 2008, as the housing bubble was building up. Following the crash, it stabilized at slightly above 50%. Private debt expanded to 20% of net wealth in the early 1990s, but then contracted, reaching a minimum of 16% in 1999-2000. It

then increased once more, reaching over 23% in 2009, the equivalent of that year's GDP. The share of business assets in total net wealth has continuously decreased from 7.5% in 1987 to just 4% in 2015, which suggests a reorientation of investment away from fixed business capital and towards financial assets or property.

Lastly, at the level of the firm, financialisation entails shareholder value reorientation. As Stockhammer (2004) argues, this can translate into higher dividend payments of non-financial corporations, at the expense of retained profits. Figure 12 shows this has been the case in the UK for the past three decades. Although highly volatile, net dividend payments made by non-financial corporations have been on an upward trend, increasing from 5% to 15% of total profits. This corresponds to an increase from 2% to 6% of as a share of GDP at factor cost (Figure 12), which we label the rentier profit share. As a result, while total profits do not exhibit a clear trend, the non-rentier profit share displays a downward trend across the period, contracting by 10 percentage points of GDP. Lower levels of retained profits may help explain sluggish corporate investment. However, Figure 11 suggests this is not the complete story. Corporate investment as a share of after-tax non-rentier profits has been on a downward trend as well. From a peak of 44% of pre-tax profits in 1989-1990, private corporate investment declined to 32% in 2017. Taking into account the reductions in the implicit tax on profits, we can infer that these have not incentivized higher rates of investment: the drop in the ratio of corporate investment to after-tax non-rentier profits is 10 percentage points since 1897.

Figure 10 The composition of real net private wealth



Source: WID database

Figure 12 Corporate investment as a share of non-rentier profits

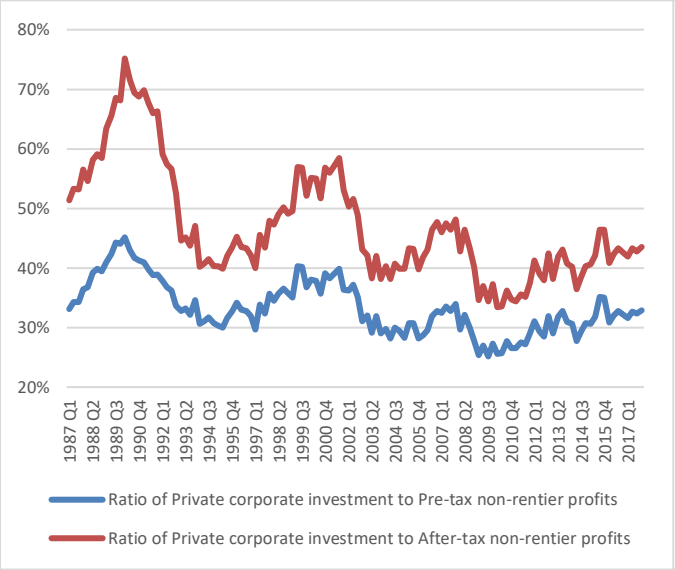
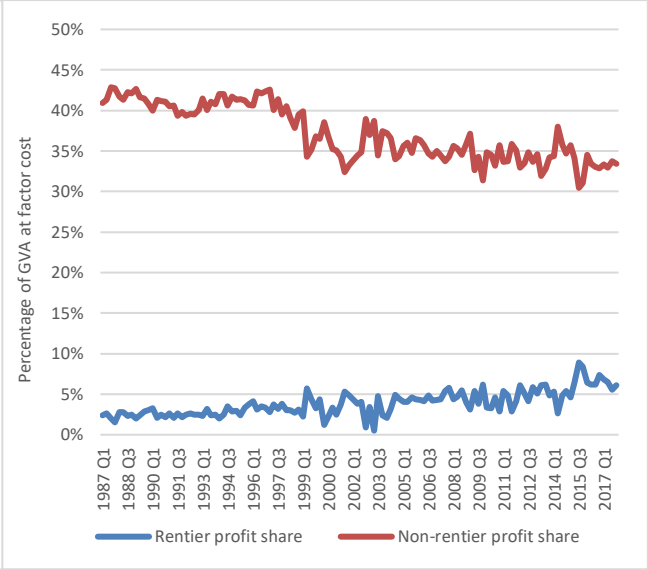


Figure 11 Rentier and non-rentier profit shares



Source: ONS and author's calculation

2. Literature Review

In the *General Theory*, Keynes (1936) posits that effective demand is the driver of the economy and that supply will adjust to demand. In this framework, investment is no longer dependent on prior saving. In a leading paper for Post-Keynesian thought, Bhaduri and Marglin (1990) propose that investment is a function of capacity utilization and the profit share, instead of the profit rate, as the latter can be decomposed into the former two variables. The authors point out that a specification of investment as a function of capacity utilization and the profit rate would double count the effect of capacity utilization. The model reconciles the Keynesian view that high real wages generate effective demand, as well as the neoclassical strand that treats them as a cost in production and allows for a Marxian profit-squeeze scenario. Two contending types of accumulation regimes follow: depending on the relative size of the investment response to changes in capacity utilization and the profit share, a contraction in the profit share would result in accumulation following a stagnationist path (also called wage-led) or an exhilirationist path (so-called profit-led). Within the stagnationist regime, a model of cooperative capitalism may be possible, where despite lower profit margins, capitalists receive higher total profits. However, this possibility has limitations, insofar as not all capitalist households benefit from higher total profits, or if in the long run the rate of accumulation does not keep pace with the growth rate of the labour force. After the publication of Bhaduri and Marglin's (1990) paper, a whole new empirical literature has sprung up seeking to determine whether demand regimes in particular countries are profit-led or wage-led, which will be reviewed in section 1. Hein (2016) labels the models that allow both demand regimes Post-Kaleckian, while Palley (2013) labels them Neo-Kaleckian

Within the empirical literature that aims to determine whether particular countries or groups of countries have wage-led or profit-led demand regimes, the main difference is one in methodology. Some authors choose a systems approach, wherein some endogeneity is allowed, and perform econometric estimations using VARs. The second method is the single equation approach, which entails the estimation of individual specifications for each component of aggregate demand. The latter method can deal with more complex models but has the disadvantage that it cannot deal with endogeneity issues.

Examples of studies using the systems approach include Barbosa-Filho and Taylor (2006) and Kiefer and Rada (2015), who employ Goodwin (1967) business cycle models, on the US and on 13 OECD countries, respectively. In both cases, results indicate a profit-led demand regime. Other examples are Stockhammer and Onaran (2004) and Onaran and Stockhammer (2005), who employ a systems approach for a neo-Kaleckian model, where the investment specification follows Bhaduri and Marglin (1990). The former study uses a system of four equations for distribution, labour productivity, unemployment and the goods market equilibrium. The model is estimated empirically on the US, the UK and France and results indicate weak effects of the profit share on demand and employment. The second model is a four-equation system of distribution, accumulation, growth, and demand-driven employment, tested empirically using a structural VAR on Turkey and South Korea. The authors find that accumulation and employment are not profit-led and the demand regime is wage-led, at least in the short run.

By comparison, studies employing the single equations approach are more numerous. Empirical results of the studies presented below are summarized in Table 1. Bowles and Boyer (1995) were the first to empirically estimate a Kaleckian two-class model using this method, for France, Germany, Japan, the UK and the US. Unlike other models presented in this section, their investment specification uses the profit rate instead of the profit share, and employment, which is regarded as a proxy for demand effects. Naastepad and Storm (2007) estimate a basic Bhaduri and Marglin (1990) model for eight OECD economies, with simple consumption, investment and exports functions. Investment is a function of demand and the profit share, while exports depend on relative unit labour costs and world demand. Stockhammer, Onaran and Ederer (2009) and Hein and Vogel (2008) use the long-run interest rate as an additional variable in the investment function. Additionally, the former paper also introduces a stepwise approach in the specification of net exports, specifying separate equations for domestic and export prices, imports and exports. Stockhammer and Stehrer (2011) estimate the model presented by Stockhammer, Onaran and Ederer (2009) in a closed economy setting, for twelve OECD countries. Their results suggest that continental European economies are predominantly wage-led, while Anglo-Saxon countries tend to have profit-led domestic demand regimes. Stockhammer, Rabinovich and Reddy (2018) include wealth effects on investment and consumption in a neo-Kaleckian closed-economy model. The model is tested empirically on the US, the UK, Germany and France in historical perspective. They find all four countries have wage-led demand regimes, and investment is also wage-led, though this result seems to be driven by residential investment – corporate investment alone is profit-led in France and the US.

Onaran and Galanis (2012) and Onaran and Obst (2016) also use the single equation approach to present an open-economy theoretical model similar to Stockhammer, Onaran and Ederer (2009). This is estimated across a panel of G20 economies and 15 European Union members, respectively. Results support the view that small open economies and, in the first case, developing export-oriented economies tend to be profit-led, while large developed economies are likely to be wage-led. Both papers simulate a simultaneous race to the bottom, where the profit share increases across the sample, depressing the wage share. Simulation results indicate that originally wage-led economies contract more than they would otherwise, while profit-led economies either contract or experience lower growth. The results point to the importance of international effects, revealing a fallacy of composition when all countries are pursuing a wage suppression strategy.

Table 1 Wage-led versus Profit-led demand regimes across the literature

Study	Profit-led demand regime	Wage-led demand regime
Barbosa-Filho and Taylor (2006)	US	
Kiefer and Rada (2015)	Panel 13 OECD economies	
Stockhammer and Onaran (2004)	US, UK, France (statistically insignificant)	
Onaran and Stockhammer (2005)		Turkey, South Korea (in the short run)
Bowles and Boyer (1995)	France, Germany, Japan	US, UK
Naastepad and Storm (2007)	US, Japan	France, Germany, Italy, the Netherlands, Spain, UK
Stockhammer, Onaran and Ederer (2009)		Euro Area

Hein and Vogel (2008)	the Netherlands, Austria	US, UK, France, Germany
Stockhammer and Stehrer (2011)	the UK, Anglo-Saxon countries (closed economy)	Germany, France, Luxembourg, the Netherlands, Sweden, Finland (closed economy)
Onaran and Galanis (2012)	Canada, Australia, China, Mexico, South Africa, India	Euro-Area 12, the UK, the US, Turkey, South Korea
Onaran and Obst (2016)	Austria, Ireland, Denmark, Belgium	Finland, France, Germany, Greece, Italy, Luxembourg, Netherlands, Portugal, Spain, Sweden, the UK, Total EU15
Obst, Onaran and Nikolaidi (forthcoming)	Belgium	Austria, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden, the UK
Onaran, Stockhammer and Grafl (2011)		US
Stockhammer and Wildauer (2016)	Austria, the Netherlands	Panel 18 OECD economies
Stockhammer, Rabinovich and Reddy (2018)		US, UK, France, Germany
Onaran, Oyvat and Fotopoulou (2019)		UK

Within Keynesian thought, fiscal policy is regarded as the most important instrument for stabilizing aggregate demand. Keynes himself advocated for a counter-cyclical fiscal policy that could stimulate demand during an economic slump, reducing its size and promoting recovery. By comparison, Kalecki (1943) argued that fiscal policy should be used at all times in order to ensure full employment. Even within mainstream economic thought, Keynesian fiscal multipliers are generally accepted and supported by empirical evidence. Within a demand and distribution framework, there are several channels through which changes in fiscal policy can affect aggregate demand. Firstly, changes in taxation can affect the after-tax functional income distribution, as Mott and Slattery (1994), Palley (2013), Obst, Onaran and Nikolaidi (forthcoming), Onaran, Oyvat and Fotopoulou (2019) argue. Ryoo and Skott (2013) simulate the fiscal requirements necessary to maintain the economy on a full-employment growth path. Secondly, capitalists if the capitalist class holds government debt, they will receive additional income in the form of interest, as in You and Dutt (1996) and Hein (2018). In such a case, increases in government debt may lead to a redistribution of income in favour of capitalists. Third, government expenditures constitute demand and can incentivize private investment as in Dutt (2013), Kapeller *et al.* (2016), Obst, Onaran and Nikolaidi (forthcoming). Lastly, productivity may depend on government expenditures, particularly government investment, as described in Tavani and Zamparelli (2017) and Onaran, Oyvat and Fotopoulou (2019).

While the channels through which financialisation works at the household, firm and even government level have been explored from a theoretical point of view, incorporating these arguments into a model that can be estimated empirically is more challenging. Financialisation can lead to an increase in financial payments, both in interest and dividends, at the corporate level. These have been documented to have a negative effect on investment by Stockhammer (2004), Orhangazi (2008), Van Treeck (2008) and Onaran, Stockhammer and Grafl (2011). Second, financialisation can also affect business indebtedness. Orhangazi

(2008) finds strong evidence that an increase in the debt-capital ratio has a negative effect on investment, while Stockhammer and Wildauer (2016) find weaker evidence in regard to the stock of business debt. Third, financialisation is associated with higher levels of indebtedness in the household sector, which can stimulate consumption, as Stockhammer and Wildauer (2016) find. Lastly, financialisation is also associated with asset price inflation. Stockhammer and Wildauer (2016) find that property prices have a positive effect on investment.

Piketty's resounding work *Capital in the Twenty-first Century* (2014) has brought renewed attention to the topic of wealth dynamics. Piketty (2014) and Piketty and Zucman (2014), point out that wealth concentration ratios have increased substantially across countries since the "golden age of capitalism" of the 1950s-1960s. Piketty (2014) explains this increase through the 'first law' of capitalism, which is derived from empirical observation and states that the profit rate is higher than the growth rate. Piketty's framework is interpreted as a model that would only allow for a corner solution, where concentration will increase until all wealth belongs to capitalists. However, as Ederer and Rehm (2018) and Petach and Tavani (2018) point out, from a Post-Keynesian perspective the "first law" holds true by definition since Pasinetti's Cambridge equilibrium equation states that the profit rate will be equal to the growth rate divided by capitalists propensity to save. It is, therefore, not a sufficient condition for a permanent increase in wealth concentration.

Mainstream empirical literature focuses solely on wealth effects on consumption (Muellbauer, 2008; Slacalek, 2009; Aron *et al.*, 2012; Arrondel, Lamarche and Savignac, 2015), finding conclusive evidence of such effects and suggesting a decreasing marginal propensity to consume out of wealth across the distribution. Recent Post-Keynesian literature has also drawn attention to wealth effects on investment (Onaran, Stockhammer and Grafl, 2011; Stockhammer and Wildauer, 2016; Onaran, Oyvat and Fotopoulou, 2019). Stockhammer and Wildauer (2016) introduce wealth effects on both consumption and investment, distinguishing by asset type. In the empirical estimation, they proxy wealth by stock and property prices, respectively, finding consistently positive effects of house prices on investment for a panel of 18 OECD economies. Stockhammer, Rabinovich and Reddy (2018) similarly include wealth effects on investment and consumption in a neo-Kaleckian closed-economy model. The model is tested empirically on the US, the UK, Germany and France using the dataset compiled by Piketty and Zucman (2014). Wealth effects in the US and the UK are positive on consumption but negative on investment, while in Germany and France there are no effects on consumption but positive effects on investment. This is consistent with the hypothesis that wealth effects on consumption are larger in market-based financial systems. On the other hand, it also indicates that the increase in wealth in these economies, which can be explained in the context of financialisation after World War II, has inhibited investment. Onaran, Oyvat and Fotopoulou (2019) integrate wealth effects by class, distinguishing between the net wealth of the top 1% and that of the bottom 99% in the consumption and private investment functions of their neo-Kaleckian model. Additionally, they specify the stock of net wealth as an endogenous path-dependent function of after-tax wage and profit income, and the wealth concentration ratio as an endogenous path-dependent function of the after-tax profit rate, the implicit tax rate on wealth and the gender wage gap. In the empirical estimation for the UK, they find that the net private wealth of the bottom 99% has a positive effect on both consumption and investment, while wealth effects for the top 1% are insignificant.

On a contrasting note, wealth distribution is a determinant of the personal income distribution. While most of the studies reviewed so far have relied on the functional income distribution, a class-based distribution that allows for blended income sources – at least for the working class – have long been a feature of Post-Keynesian thought. In such a case, capital or wealth ownership shares determine the distribution of profits between the two classes. Pasinetti (1962) was the first Post-Keynesian to shift the focus towards this type of distribution. In his model, workers receive a share of profit income equal to their capital ownership share, while capitalists receive only profit income. Assuming differential saving propensities, Pasinetti derives the famous Cambridge equation which states that on the steady growth path the profit rate is equal to the ratio between the natural rate of growth and capitalists' propensity to save, being thereby completely independent of workers' saving propensity. In this framework, both classes own a positive share of the capital stock in long-run equilibrium. Following Dutt (1990), Palley (2012) reinterprets the Kaldor-Passinetti Cambridge condition as an ownership equilibrium condition. A number of Post-Keynesian studies follow suit and attempt to simulate the long-run equilibrium wealth concentration (Taylor, Foley and Rezai, 2018; Ederer and Rehm, 2018; Petach and Tavani, 2018).

3. The model

Given the recent developments in the UK economy described in section 1, we consider the need for a consolidated neo-Kaleckian model of an open economy with government which integrates both financialisation and wealth effects. The main features of the model are the following: i. the government sector is integrated by considering the after-tax distribution of income and wealth, government consumption expenditure and government investment effects, as well as government debt effects on private investment; ii. we distinguish between household investment and corporate investment, proposing that the former behaves in a consumption-like manner, while the latter is an extension of the Bhaduri and Marglin's (1990) specification; iii. we allow for different wealth effects for the top 1% and the bottom 99% of the wealth distribution on consumption, investment and imports; iv. we integrate financialisation effects at the level of non-financial corporations by separating net dividends paid by non-financial corporations from the rest of profits, and treating the former as "rentier profits"; v. we integrate financialisation effects in asset markets by considering the effects of share and house price inflation on the value of net wealth and net wealth concentration.

We start from the Bhaduri and Marglin (1990) model and introduce a government sector in a similar manner to Obst, Onaran and Nikolaidi (forthcoming), integrating tax rates on labour income, profits, wealth and consumption, government investment and government consumption, and government debt. We expand the model to integrate wealth effects on consumption and investment following Stockhammer and Wildauer (2016) and Stockhammer, Rabinovich and Reddy (2018), but distinguish between the wealth of the bottom 99% and the top 1% in order to capture the effect of rising wealth concentration, in a similar manner to Onaran, Oyvat and Fotopoulou (2019).

Financialisation can manifest itself in different forms. One well-documented symptom of financialized economies is shareholder value reorientation. This will take the form of rising net dividend payments to shareholders that leave a smaller share of profits available for reinvestment. We capture this by integrating a rentier profit share alongside a non-rentier profit share, in a similar manner to Onaran, Stockhammer and Grafl (2011). Another form of shareholder value reorientation is the increase in share buy-backs which can push stock prices upwards. Such an effect will be captured by integrating stock prices into our model. Secondly, financialisation is also associated with property price inflation and property bubbles. We capture these by including property prices into our model.

The model has three contributions. The first is that we develop separate equations for household and corporate investment. Recognizing that household investment is not profit-driven, we model it in a consumption-like manner. Corporate investment is modelled building on Bhaduri and Marglin (1990) equation, extended with wealth and financialization effects. The second innovation is that the model allows us to capture the channels through which stock and property bubbles can affect aggregate demand. These do not have direct effects on consumption and investment. Instead, rising stock and property prices inflate the value of wealth and can increase wealth concentration. Rising wealth and wealth concentration, in turn, affect consumption and investment. Third, our net export specification allows for an increasing marginal propensity to import across the income and wealth distribution.

We define separate behavioural equations for each component of aggregate demand: household consumption, household investment, corporate investment, imports, exports, domestic and export price indices. We treat government investment and consumption as ratios of GDP and interpret any changes to these ratios as the result of exogenous fiscal political decisions.

Aggregate demand (AD) consists of household consumption (C), investment (I), government consumption expenditure (G) and net exports. Investment can be carried out by households (I_h), private corporations (I_c), public corporations (I_{pc}) and the government (I_g). Net exports are exports (X) minus imports (M). Income (Y) is distributed between profits (R), consisting of rentier (R_r) and non-rentier profits (R_{nr}), and wages (W). This distribution is determined by two parameters: the profit share (π) and the rentier share of profits (ρ). The profit share can be decomposed into the rentier profit share (π_r) and the non-rentier profit share(π_{nr}). Y_p stands for private demand.

$$AD = Y \tag{1}$$

$$AD = C + I + G + (X - M) \tag{2}$$

$$I = I_h + I_c + I_g + I_{pc} \tag{3}$$

$$Y = R + W \tag{4}$$

$$\pi = \frac{R}{Y}, \qquad 0 < \pi < 1 \tag{5}$$

$$R = R_r + R_{nr} \tag{6}$$

$$\rho = \frac{R_r}{R}, \qquad 0 < \rho < 1 \tag{7}$$

$$\pi_{nr} = \frac{R_{nr}}{Y} \tag{8}$$

$$\pi_r = \frac{R_r}{Y} \tag{9}$$

$$Y_p = Y - (G + I_g + I_{pc}) \tag{10}$$

Economic agents accumulate wealth and debt. Their net wealth (V) is equal to the value of their financial assets (FA), housing assets (HA), business and other assets (A_c) less private debt (D_p). φ is the net wealth-income ratio and Θ stands for wealth concentration, indicating the share of net wealth owned by the top 1% of households (V_1) in total wealth.

$$V = (FA + HA + A_c) - D_p \tag{11}$$

$$\varphi = \frac{V}{Y}, \qquad \varphi > 0 \tag{12}$$

$$\theta = \frac{V_1}{V}, \qquad 0 < \theta < 1 \tag{13}$$

Government revenue (T) consists of taxes on labour income, profits, wealth and consumption, collected at the rates t_w, t_r, t_v, t_c, respectively. Government expenditures consist of consumption and investment and are defined as ratios k_c and k_i with respect to output. The primary budget balance (PB) is the difference between revenues and expenditures. We assume that budget deficits are financed entirely through debt issuance, in accordance with Dutt (2013), Obst, Onaran and Nikolaidi (forthcoming) and Onaran, Oyvat and Fotopoulou (2019). Each year, the stock of government debt will increase with the primary budget deficit and the interest paid on the previous year's debt (D_g^{-1}) at the real interest rate on government bonds r_g.

$$T = t_w W + t_r R + t_v V + t_c C \tag{14}$$

$$PB = T - (G + I_g) \tag{15}$$

$$D_g = D_g^{-1} + r_g D_g^{-1} - PB \tag{16}$$

$$G = k_c Y \tag{17}$$

$$I_g = k_i Y \tag{18}$$

Household consumption (C) is a function of autonomous consumption (c_a), wages, rentier profits, non-rentier profits, the wealth of the top 1% and that of the bottom 99%. All these variables are after-tax based on the implicit tax rates on wages, profits and wealth. In this regard, we follow Obst, Onaran and Nikolaidi (forthcoming) and Onaran, Oyvat and Fotopoulou (2019), and concur that households can only consume out of their disposable income. In a typical Post-Keynesian fashion, the functional income distribution between profits and wages plays an important role in determining the level of consumption. In this regard, all the studies reviewed in Chapter I that contain an empirical estimation of consumption include the functional income distribution in their consumption function. Some theoretical papers (Palley, 2012, 2013, 2017; Ederer and Rehm, 2018; Taylor, Foley and Rezai, 2018) specify a class-based distribution with blended income sources in the consumption function. However, given data limitations, the empirical application of such models is not feasible. Hence, we utilize the functional income distribution in our specification, without any claim that this represents a class-based distribution. Still, we assume that the marginal propensity to consume out of wage income (c_w) is higher than that out of profit income, whether rentier (c_{rr}) or non-rentier (c_{nr}). The rationale is twofold: first, the marginal propensity to consume is diminishing across the income distribution; second, those at the bottom of the income distribution are predominantly wage-earners, while profit-earners will be more concentrated towards the top. Following Onaran, Stockhammer and Grafl (2011), we distinguish between rentier and non-rentier profits and

hypothesize that the marginal propensity to consume out of rentier profit income (c_{rr}) is higher than that out of non-rentier profit income (c_{nr}). Non-rentier profits consist to a large extent of retained profits. However, given the framework of the national accounts, they also include imputed rentals of owner-occupiers, which are carried through to household consumption. This implies a de facto marginal propensity to consume of 1 out of such imputed income, therefore biasing c_{nr} upwards.

Lastly, we allow for wealth effects, following Onaran, Stockhammer and Grafl (2011), Palley (2012), Stockhammer and Wildauer (2016), and Onaran, Oyvat and Fotopoulou (2019). The presence of such effects has also been documented in empirical studies using household survey microdata (Muellbauer, 2008; Slacalek, 2009; Aron *et al.*, 2012). Wealth effects are usually explained through the collateral channel, whereby households use their assets as collateral in order to take out loans for consumption purposes. By comparison to most of the literature, we do not distinguish wealth by asset type. Instead, since we are interested in the effect of wealth concentration on aggregate demand, we distinguish between the net wealth of the top 1% and that of the bottom 99%, in a similar manner to Onaran, Oyvat and Fotopoulou (2019). In accordance with their result, as well as estimates using household survey microdata (Arrondel, Lamarche and Savignac, 2015), we assume a diminishing marginal propensity to consume across the wealth distribution: the marginal propensity to consume out of wealth of the bottom 99% (c_{v99}) is expected to be larger than that of the top 1% (c_{v1}).

$$\begin{aligned} logC = c_a + c_w log[W(1-t_w)] + c_{rr} log[R_r(1-t_r)] + c_{nr} log[R_{nr}(1-t_r)] \\ + c_{v99}\, log[V_{99}(1-t_v)] + c_{v1} log[V_1(1-t_v)], \\ c_a > 0, 0 < c_{v1} < c_{w99} < c_{rr} < c_{nr} < c_w < 1 \end{aligned} \quad (19)$$

We distinguish between household and corporate investment and model them separately. Keeping in mind arguments proposed by Stockhammer and Wildauer (2016) and Stockhammer, Rabinovich and Reddy (2018), we consider household investment (I_h) to behave in a consumption-like manner. Housing construction and improvements, which are not done for profit motives, dominate household investment. As a result, household investment will depend on animal spirits (h_a), income and wealth distribution. Our specification is almost identical to the consumption specification, with h_w, h_{rr}, h_{nr}, h_{v99}, h_{v1} standing for households' marginal propensities to invest out of after-tax labour income, rentier profit income, non-rentier profit income, the wealth of the bottom 99% and wealth of the top 1%, respectively. By comparison to consumption, however, we expect wealth effects to be more pronounced (h_{v99}>h_{v1}> c_{v99}>c_{v1}), as the collateral channel will be stronger – most securitized loans are still used for property purchases rather than consumption purposes. Changes in after-tax income matter both as a direct source of funds, but also because it factors into bank lending decisions. Moreover, it is not a priori clear whether income effects will be larger than wealth effects, as in the case of consumption. This is due to the fact that the funds needed to finance investment are larger, such that prior savings and debt finance, which are part of net wealth, will play a significant role. Lastly, we allow for a crowding-out effect (h_d) of rising public debt-output ratio on investment, insofar as increased government indebtedness leads to an increase in interest rates on loans making debt financing more costly for households. The effect of government debt on interest rates is a hot topic in mainstream debate and empirical results are mixed (Engen and Hubbard, 2004). The theory is based on the assumption of exogenous money supply, such that any government

borrowing will leave fewer funds available for private-sector borrowing. As Post-Keynesian economists, we reject this view, supporting instead the endogenous money theory, whereby bank lending is not constrained by previous saving. Nonetheless, we include government debt in our investment specifications in order to test for any negative effects.

$$\begin{aligned} logI_h = {} & h_a + h_w \log[W\,(1-t_w)] + h_{rr} \log[R_r(1-t_r)] + h_{nr} \log[R_{nr}(1-t_r)] \\ & + h_{v99}\log[V_{99}(1-t_v)] + h_{v1}\log[V_1(1-t_v)] + h_d \log\left(\frac{D_g}{Y}\right), \\ & h_a > 0, 0 < h_{rr}, h_{nr}, h_w, h_{v1}, h_{w99} < 1, h_d < 0 \end{aligned} \tag{20}$$

Our specification of corporate investment (I_c) extends Bhaduri and Marglin (1990), where investment is a function of the rate of capacity utilization and the profit share. However, because data on capacity utilization rates is not always available and reliable, most Post-Kaleckian studies with empirical applications proxy it with aggregate demand, assuming investment will respond to changes in demand (Naastepad and Storm, 2007; Hein and Vogel, 2008; Stockhammer, Onaran and Ederer, 2009; Stockhammer and Stehrer, 2011; Onaran and Galanis, 2012; Onaran and Obst, 2016; Stockhammer and Wildauer, 2016; Obst, Onaran and Nikolaidi, forthcoming; Stockhammer, Rabinovich and Reddy, 2018b; Onaran, Oyvat and Fotopoulou, 2019). We follow this approach, but distinguish private demand (Y_p) from and government expenditures, as in Obst, Onaran and Nikolaidi (forthcoming), in order to analyse the effect of different types of spending and investment in infrastructure, in particular. The coefficient i_Y captures the effects of changes in private demand on corporate investment. Investment also depends on animal spirits (i_a) and profitability. As an indicator of the latter, we chose the after-tax profit share, following the argument of You and Dutt (1996), Obst, Onaran and Nikolaidi (forthcoming) and Onaran, Oyvat and Fotopoulou (2019). The financialisation literature (Stockhammer, 2004; Orhangazi, 2008; Van Treeck, 2008; Onaran, Stockhammer and Grafl, 2011) suggests that financialisation variables, such as dividend and interest income or payments, may have a negative effect on investment. We therefore include the rentier and non-rentier profit shares separately. We thus aim to test the hypothesis that shareholder value orientation which translates into higher dividend disbursements depresses investment, reducing the pool of funds available for reinvestment and incentivizing financial speculation at the expense of fixed capital accumulation. The coefficients i_{nr} and i_{rr} indicate the effects of changes the non-rentier and the rentier profit shares. We expect the propensity to invest out of non-rentier profits to be positive, while, in accordance with the literature on financialisation effects, we expect the coefficient of rentier profits to be negative.

Additionally, we allow for wealth effects on corporate investment, again distinguishing between the wealth of the top 1% and the bottom 99%, so as to capture the effect of changes in wealth concentration. In the recent literature, very few studies allow for wealth effects on investment (Stockhammer and Wildauer, 2016; Stockhammer, Rabinovich and Reddy, 2018, Onaran, Oyvat and Fotopoulou, 2019). Depending on the variables and the country choice, these studies suggest there is a possibility of both positive and negative effects. Positive effects are mainly explained through the importance of the collateral and debt channels in residential investment, as the authors do not develop separate investment functions. However, we argue that an increase in net wealth could also affect corporate investment

positively, either through the collateral channel or by reducing capitalists' risk aversion. Negative effects are considered an indication of the perverse effect of financialisation, which incentivizes speculation in financial and property markets at the expense of fixed capital formation. Given that financial wealth distribution is skewed towards the top (ONS, 2018b), negative effects are more likely for net wealth of the top 1%. The coefficients i_{v99} and i_{v1} indicate the effects of changes the net wealth of the bottom 99% and the top 1%, respectively. We do not theoretically restrict the sign or relative size of these coefficients and aim to estimate them empirically.

The government sector affects the corporate investment through the inclusion of taxes, government investment, government consumption and the public debt ratio. Following Dutt (2013), Obst, Onaran and Nikolaidi (forthcoming) and Tavani and Zamparelli (2017) we distinguish between government investment and consumption expenditures, expecting positive crowding effects (i_{ig} and i_g) on corporate investment. An increase in government consumption (G) and investment by public corporations (I_{pc}) will constitute additional demand and stimulate investment in a similar manner to an increase in private demand. By comparison, government investment in infrastructure and innovation will play a more important role, reducing costs or having spillover effects on the private sector. Lastly, as already explained above, we test for a "crowding out" effect (i_d) of rising public debt-output ratio on investment, given that neoclassical economic theory suggests increased government indebtedness leads to an increase in bank interest rates making debt financing more costly for businesses.

$$\begin{aligned} logI_c = {} & i_a + i_y logY_p + i_{nr}\log[(1-t_r)\pi_{nr}] + i_{rr}\log[(1-t_r)\pi_r] \\ & + i_{v99}\log[V_{99}(1-t_v)] + i_{v1}[V_1(1-t_v)] + i_d \log\left(\frac{D_g}{Y}\right) + i_{ig} logI_g \\ & + i_g logG + i_{pc} logI_{pc}, \\ & i_{rr} < 0, i_{ig} > i_g > 0, i_{pc} > 0, i_d < 0, i_a, i_y, i_{nr} > 0, i_{v1}?, i_{v99}? \end{aligned} \tag{21}$$

Net exports are analysed using a stepwise approach, first proposed by Stockhammer, Onaran and Ederer (2009) and also used by Onaran and Galanis (2012), Onaran and Obst (2016), Obst, Onaran and Nikolaidi (forthcoming), Onaran, Oyvat and Fotopoulou (2019). This entails developing separate equations for domestic and export prices, imports and exports. Domestic prices (P) and export prices (P_x) depend on domestic nominal unit labour costs (ULC) and import prices (P_m).

$$logP = p_0 + p_{ulc} logULC + p_m logP_m \tag{22}$$

$$p_0, p_{ulc}, p_m > 0$$

$$logP_x = p_{x0} + p_{xulc} logULC + p_{xm} logP_m \tag{23}$$

$$p_{x0}, p_{xulc}, p_{xm} > 0$$

Exports (X) are a function of relative export and import prices, foreign aggregate demand (Y_f) and the nominal exchange rate (E).

$$logX = x_0 + x_{pm} log\left(\frac{P_x}{P_m}\right) + x_f logY_f + x_e logE$$
$$x_0, x_f, x_{pm} > 0, x_e < 0 \quad (24)$$

Imports (M) depend on relative domestic and import prices, the exchange rate, domestic income, wealth and government expenditure. We allow for different marginal propensities to import out of wages (m_w), rentier (m_{rr}) and non-rentier profit income (m_{nr}). We expect $m_{rr}>m_w$, as we assume an increasing marginal propensity to import across the income distribution - higher-income earners are more prone to import luxury goods from abroad. The propensity to import out of the non-rentier profit share will mainly indicate corporations' acquisition of raw materials and equipment from abroad. Stockhammer and Wildauer (2016) allow for wealth effects on imports. Our model goes a step further, assuming an increasing propensity to import across the wealth distribution, with $m_{v1}>m_{v99}$, where the first coefficient stands for the propensity to import out of the wealth of the top 1% and the latter is the propensity to import out of the wealth of the bottom 99%. These effects have not been included previously in a Neo-Kaleckian model, to the best of our knowledge. Lastly, in a similar manner to Obst, Onaran and Nikolaidi (forthcoming), we recognize that an increase in government investment and consumption expenditures may lead to an increase in imports if there are government acquisitions from foreign producers. These effects will be captured by coefficients m_{ig} and $m_{g,}$ which are import propensities in government investment and consumption expenditures, respectively. m_0 stands for autonomous imports.

$$\begin{aligned} logM = m_0 + m_{pm} log\left(\frac{P}{P_m}\right) + m_w \log\left[W(1-t_w)\right] + m_{rr} \log\left[R_r(1-t_r)\right] \\ + m_{nr} \log\left[R_{nr}(1-t_r)\right] + m_{v99} \log\left[V_{99}(1-t_v)\right] \\ + m_{v1}[V_1(1-t_v)] + m_{ig} logI_g + m_g logG + m_e logE \end{aligned} \quad (25)$$
$$m_0, m_{pm}, m_w, m_{rr}, m_{nr}, m_{v99}, m_{v1}, m_{ig}, m_g, m_e > 0$$

Net wealth and net wealth concentration are endogenously determined in our model. Theoretical models derive these changes as identity equations. Reinterpreting the Pasinetti equation (Pasinetti, 1962), wealth concentration is determined by differential saving propensities between workers and capitalists and the functional income distribution (Palley, 2012, 2017; Ederer and Rehm, 2018; Taylor, Foley and Rezai, 2018). Deriving such identity equations for net wealth is not possible as long as the debt distribution is unknown. Therefore, Onaran, Oyvat and Fotopoulou (2019), who also empirically estimate their model, consider after-tax net wealth to be a path-dependent function of after-tax wage and profit income, in order to derive net saving propensities. Wealth concentration is a path-dependent function of the after-tax profit share and the tax rate on wealth.

Nonetheless, changes in the value of net wealth will also depend on changes in asset prices. Additionally, Stockhammer and Wildauer (2017) show that changes in property prices are the main driver behind the increase in household debt. As a result, the picture would be incomplete without allowing for asset price effects on net wealth. We propose that after-tax net wealth is a path-dependent function of the after-tax non-rentier and rentier profit shares. This involves a redistribution of income away from households with a lower propensity to save towards households with a higher propensity to save, such that wealth will increase at a faster rate than it would have otherwise. Rising stock prices (P_s) and housing prices (P_h) will inflate the value of net wealth.

$$\begin{aligned}\log[(1-t_v)V] = \; & logV^{-1} + v_0 + v_{nr}\log[(1-t_r)\pi_{nr}] + v_{rr}\log[(1-t_r)\pi_r] \\ & + v_{ps}P_s + v_{ph}P_h \\ & v_0, v_{nr}, v_{rr}, v_{ps}, v_{ph} > 0\end{aligned} \tag{26}$$

Wealth concentration (Θ) will also depend on the rentier and non-rentier profit shares, since we assume profit-earners are concentrated at the top of the wealth distribution. Stock and house prices can also affect wealth concentration, since those in the first deciles of the wealth distribution do not generally hold such assets.

$$\begin{aligned}log\theta = \; & \theta_0 + \theta_{nr}\log\,[R_{nr}(1-t_r)] + \theta_{rr}log\,[R_r(1-t_r)] + \theta_{ps}logP_s + \\ & \theta_{ph}logP_h, \\ & \theta_0, \theta_{nr}, \theta_{rr}, \theta_{ps}, \theta_{ph} > 0\end{aligned} \tag{27}$$

4. Methodology and results

We estimate separate single equations for household consumption, household investment, private corporate investment, domestic and export prices, exports, imports, net wealth and the net wealth concentration ratio. The single equations approach is widely used in the literature reviewed (Bowles and Boyer, 1995; Naastepad and Storm, 2007; Stockhammer, Onaran and Ederer, 2009; Hein and Vogel, 2008; Stockhammer and Stehrer, 2011; Onaran, Stockhammer and Grafl, 2011; Onaran and Galanis, 2012; and Onaran and Obst, 2016; Stockhammer and Wildauer, 2016, Stockhammer, Rabinovich and Reddy, 2018; Onaran, Oyvat and Fotopoulou, 2019; Obst, Onaran and Nikolaidi, forthcoming). Augmented Dickey-Fuller tests are applied to test for unit root processes. If all the variables in an equation are integrated of order 1, we estimate an error correction model (ECM). When the ECM is statistically significant, we test for cointegration using the set of critical values provided by Banerjee, Dolado and Mestre (1998) for the t-statistic of the speed of adjustment coefficient. In the absence of cointegration, we estimate an OLS in 1st difference. Given that our dataset is at quarterly frequency, we start with a specification that includes eight lags of the regressors and the lagged dependent variable. We use a general to specific approach in order to arrive at a more parsimonious specification. If econometric results are at odds with established economic theory, we experiment with shorter lags of the regressors. While we prefer a specification that excludes contemporaneous effects in order to avoid endogeneity issues, we experiment with alternative specifications that include contemporaneous values of the regressors and report them when econometric results and economic theory suggest such effects are particularly important. Lastly, we test for autocorrelation using the Breusch-Godfrey Serial Correlation LM Test.

This section presents the estimation results for the household consumption equation. All variables in the household consumption function are integrated of order one (see Table 1 in Appendix 2). The ECM is insignificant, so we proceed to estimate an OLS in 1st difference. We experiment with different lag lengths after the specification with eight lags of the regressors yields results which are at odds with economic theory: the marginal propensity to consume out of wage income appears to be negative. The lagged dependent variable is mostly insignificant as an explanatory variable for shorter lag lengths. We settle on a specification with contemporaneous and lagged values of the regressors up to the fifth lag, which excludes the lagged dependent variable. We use a general to specific approach to arrive at the more parsimonious specification presented in Table 1 of Appendix 3[1]. We test for serial correlation using the Breusch-Godfrey Serial Correlation LM Test. We cannot reject the null hypothesis of no serial correlation at the 10% level and conclude that the specification reported does not suffer from serial correlation.

Adding up the effects of statistically significant lags, results indicate that, at the sample mean, the marginal propensity to consume out of wage income is 0.76, while the marginal propensity to consume out of rentier profit income is 0.26 and that out of non-rentier profit income is 0.23. This confirms our hypothesis that the marginal propensity to consume out of wage income is higher than that out of profit income. The hypothesis that the marginal propensity to consume out of rentier profit income is higher than that out of non-rentier profit income is also confirmed. However, we fail to find statistically significant effects of the net wealth of the bottom 99% and the top 1% on household consumption.

[1] This final specification is robust to starting with four lags of the explanatory variables.

Conclusion and future work

To conclude, starting from an analysis of the main changes that have taken place in the UK economy in the last three decades, we have developed a neo-Kaleckian open-economy model that includes a detailed government sector, wealth effects of the endogenously determined net wealth of the top 1% and the bottom 99%, financialisation effects of rising net dividend payments of non-financial corporations and asset price inflation. Our theoretical model has three contributions. The first is that we develop separate equations for household and corporate investment. As shown in our literature review, this has not been done previously, even though some studies have arrived at empirically conflicting results. We hope that our method will help clarify the profit-led character of private corporate investment, as opposed to the wage-led character of household investment. The second innovation is that the model allows us to capture the channels through which stock and housing bubbles can affect aggregate demand. We argue that these do not have direct effects on consumption and investment. Instead, rising stock and property prices inflate the value of wealth and can increase wealth concentration. Rising wealth and wealth concentration, in turn, affect consumption and investment. Third, our net export specification allows us to test for an increasing marginal propensity to import across the income and wealth distribution.

Estimation results for the household consumption function confirm our hypothesis that the marginal propensity to consume out of rentier profit income is higher than that out of non-rentier profit income, while the marginal propensity to consume out of wage income is much higher than both. However, we do not find statistically significant evidence for wealth effects on consumption.

Future work

Firstly, we will econometrically estimate the equations for household investment, private corporate investment, domestic and export prices, imports and exports, net wealth and the net wealth concentration ratio. As already outlined in our theoretical model, we expect household investment to behave in a consumption-like manner, while only corporate investment is expected to be profit-driven. The increase in net dividend payments by non-financial corporations, expressed as the rentier profit share, is expected to have a negative effect on private corporate investment. Asset price inflation is expected to inflate the value of net wealth, as well as lead to increased wealth concentration, with second-round effects on consumption and investment. Secondly, we will develop a theoretical analysis of the effects on individual demand components as well as aggregate demand for the following: i. changes in income distribution, between wages and profits, and between non-rentier and rentier profits; ii. changes in tax rates on wages, profit income and wealth; iii. increases in government consumption and investment expenditures and government debt; iv. asset price inflation affecting wealth and wealth concentration, with second-round effects on demand components. Thirdly, we will simulate such effects for the UK, using the theoretical solutions and the empirical estimation results. Lastly, we will conclude by formulating several policy recommendations based on the results of our simulations for the UK.

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Appendices

Appendix 1. Data

Table 1 Data description and sources

Variable name	Definition	Source
D_g/Y	Ratio of General government consolidated gross debt to Gross Value Added at factor cost	ONS Public sector finances time series Dec 2018 update
G	Real General Government: Final consumption expenditure	ONS UKEA dataset Sep 2018 update
C	Real Household final consumption expenditure: Domestic Concept	ONS UKEA dataset Sep 2018 update
I	Real Total Gross Fixed Capital Formation	ONS UKEA dataset Sep 2018 update
I_C	Real Private Corporate Gross Fixed Capital Formation: Sum of Private non-financial corporations Gross fixed capital formation and Financial Corporations Gross fixed capital formation	ONS UKEA dataset Sep 2018 update
I_G	Real General Government Gross Fixed capital formation	ONS UKEA dataset Sep 2018 update
I_h	Real Households Gross fixed capital formation	ONS UKEA dataset Sep 2018 update
I_{pc}	Real Public Corporations Gross fixed capital formation	ONS UKEA dataset Sep 2018 update
t_c	Implicit tax rate on consumption	Eurostat Implicit tax rates series (no longer available) and European Commision "Taxation Trends" Reports
t_l	Implicit tax rate on Labour	Eurostat Implicit tax rates series (no longer available) and European Commision "Taxation Trends" Reports
t_v	Implicit tax rate on wealth	Author's calculation based on Eurostat Implicit tax rates series (no longer available) and European Commission "Taxation Trends" Reports
t_r	Implicit tax rate on capital income	Author's calculation based on Eurostat Implicit tax rates series (no longer available) and European Commision "Taxation Trends" Reports
V	Real Net private wealth	Author's calculation based on WID data and Credit Suisse Research Institute Global Wealth Reports
V_1	Real Net private wealth of the top 1%	Author's calculation based on WID data and Credit Suisse Research Institute Global Wealth Reports

θ	Wealth concentration ratio. Share of net personal wealth owned by the top 1%	Author's calculation based on WID data and Credit Suisse Research Institute Global Wealth Reports
V_{99}	Real Net private wealth of the bottom 99%	Author's calculation based on WID data and Credit Suisse Research Institute Global Wealth Reports
R	Real Total profits. Adjusted gross operating surplus	Author's calculation based on ONS UKEA dataset Sep 2018 update
R_{nr}	Real Non-rentier profits. Adjusted gross operating surplus less net dividend payments by non-financial corporations	Author's calculation based on ONS UKEA dataset Sep 2018 update
π_{nr}	Non-rentier profit share. Adjusted gross operating surplus less net dividend payments by non-financial corporations divided by Gross Value Added at factor cost	Author's calculation based on ONS UKEA dataset Sep 2018 update
R_r	Real Rentier profits. Net dividend payments by non-financial corporations	Author's calculation based on ONS UKEA dataset Sep 2018 update
π_r	Rentier profit share. Net dividend payments by non-financial corporations divided by Gross Value Added at factor cost	Author's calculation based on ONS UKEA dataset Sep 2018 update
π	Profit share. Adjusted gross operating surplus divided by Gross Value Added at factor cost	Author's calculation based on ONS UKEA dataset Sep 2018 update
W	Real Labour compensation. Compensation of employees adjusted for self-employment	Author's calculation based on ONS UKEA dataset Sep 2018 update
Y	Real Gross Value Added at factor cost	ONS UKEA dataset Sep 2018 update
P_s	Share price index deflated using the GDP deflator	OECD. GDP deflator source: ONS UKEA dataset Sep 2018 update for GDP deflator series
P_h	UK house price index deflated using the GDP deflator	GOV.UK. GDP deflator source: ONS UKEA dataset Sep 2018 update for GDP deflator series

Table 2 Descriptive statistics

Variable name	Mean	Median	Maximum	Minimum	Std. Dev.	Observations
D_g/Y	0.56514	0.457467	1.001036	0.309537	0.235124	124
G	70499.45	70500.74	94776.08	45058.13	18333.56	124
C	237526.5	248407.3	313797.8	158093.5	45415.14	124
I	68213.68	68709.19	86999.27	51625.58	8554.205	124
I_C	41023.21	41272.36	48406.92	31149.81	4124.317	124
I_G	9448.227	8641.86	14603.05	4101.829	2972.67	124
I_{pc}	3019.109	2901.081	22496.40	1336.779	1983.793	124
I_h	12117.45	11585.93	18509.24	7258.621	3026.256	124
t_c	0.192558	0.193976	0.200633	0.174644	0.005673	124

t_l	0.249336	0.25074	0.262	0.235188	0.007051	124
t_v	0.009832	0.009889	0.012083	0.008315	0.000939	124
t_r	0.284616	0.268517	0.412888	0.226317	0.049714	124
V	6383628	6592649	9544269	3014776	2062369	124
V_1	1253009	1190562	2156564	502661.6	523200.6	124
θ	0.190161	0.188783	0.238859	0.152034	0.0225	124
V_{99}	5130619	5434074	7387705	2512114	1552048	124
R	138310	135162.3	176157.1	99683.79	20574.24	124
R_{nr}	124522.4	124690.3	157344	94160.01	14799.9	124
π_{nr}	0.371861	0.364015	0.428632	0.304548	0.033955	124
R_r	13787.59	11927.45	37862.1	1804.016	7543.451	124
π_r	0.038489	0.035924	0.089096	0.005056	0.015298	124
π	0.41035	0.401278	0.4564	0.374977	0.023541	124
W	201558.9	211652	266238.7	130616.5	43294.46	124
Y	339868.9	346444.8	440200.1	230300.3	63097.46	124
P_s	90.43577	91.72833	136.1628	53.97343	90.43577	124
P_h	76.17589	78.66974	115.5223	41.42392	76.17589	124

Appendix 2. Unit root tests

Table 1 Augmented Dickey-Fuller test for the Consumption equation

	Log(C)	**Log(W(1-t_w))**	**Log(R_r(1-t_r))**	**Log(R_{nr}(1-t_r))**	**Log(V_{99}(1-t_v))**	**Log(V_1(1-t_v))**
ADF p-value	0.3127	0.4296	0.2467	0.3977	0.6261	0.5514
Root	Yes	Yes	Yes	Yes	Yes	Yes
	ΔLog(C)	**ΔLog(W(1-t_w))**	**ΔLog(R_r(1-t_r))**	**ΔLog(R_{nr}(1-t_r))**	**ΔLog(V_{99}(1-t_v))**	**ΔLog(V_1(1-t_v))**
ADF p-value	0	0.0202	0	0	0.0468	0.073
Root	No	No	No	No	No	No

Appendix 3. Estimation results

Table 1 Household consumption equation

Dependent Variable: ΔLog(C)		
Sample: 1987Q4-2017Q4		
Included observations: 121		
Variable	Coefficient	p-value
Constant	0.001618 (0.000887)	0.0709
ΔLog (W(1-t_w))	0.293623 (0.052908)	0
ΔLog (W^{-2}(1-t_w^{-2}))	0.136775 (0.068362)	0.0478

$\Delta Log(R_r^{-1}(1-t_r^{-1}))$	0.003957 (0.002275)	0.0848
$\Delta Log\ (R_r^{-2}(1-t_r^{-2}))$	0.006715 (0.002245)	0.0034
$\Delta Log\ (R_{nr}^{-1}(1-t_r^{-1}))$	0.026567 (0.015792)	0.0953
$\Delta Log\ (R_{nr}^{-2}(1-t_r^{-2}))$	0.052676 (0.019328)	0.0075
$\Delta Log\ (V_{99}^{-1}(1-t_v^{-1}))$	0.070503 (0.067118)	0.2958
$\Delta Log\ (V_1(1-t_v))$	0.023707 (0.037925)	0.5332
Adjusted R-squared: 0.308904		
Durbin-Watson statistic: 2.18561		
Breusch-Godfrey Serial Correlation LM Test Null hypothesis: No serial correlation at up to 8 lags		
F-statistic	1.197737	Prob. F (8,104) 0.3076
Obs*R-squared	10.20769	Prob. Chi-Square(8) 0.2508